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EXPERIMENTS
AND
Conſiderations
ABOUT THE
Poroſity of Bodies,
IN TWO
ESSAYS.

By the Honourable
ROBERT BOYLE,
Fellow of the Royal Society.

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EIGENTHUM DES COLL
IN
AUGSBURG

TO THE

READER.

THe Reader is to be advertis'd, not to expect in the following Eſſay a Regular, or ſo much as a Coherent, Diſcourſe. For it was intended only as a collection of looſe Experiments and Obſervations about the Poroſity of the parts of Bodies belonging as Chymiſts ſpeak) to the Animal Kingdom, and laid (not to ſay thrown (together, in order to what I had thoughts of offering, towards an Intelligible account of Occult Qualities. I am not ignorant, that even one of the moſt ancient and famous of Phyſicians hath ſaid, that a mans body is *(almoſt) every where perſpirable. But I judg'd that a Doctrine of ſuch moment, and which diverſe things in the Theory and Practice of after Phyſicians may make one think they either disbelieved or diſregarded, did not deſerve to be ſlightly deliver'd, and in general terms, but to be more narrowly conſidered, and likewiſe made out by Particular Inſtances, whoſe applyableneſs and uſefulneſs to explain divers obſcure* Phænomena, *may hereafter appear much greater, then perchance at the firſt ſight they will be thought.*

And the foregoing advertiſement, with a light change, which 'tis preſum'd the Reader may eaſily make of himſelf, is to be extended to the Eſſay tacked to this about the Pores of Solid Bodies, *and ſo may excuſe the abſence of a diſtinct Preface to it.*

An Eſſay of the POROUSNESS OF ANIMAL BODIES.

AS the moſt numerous part of the Pores of Bodies is too minute to be ſeen, ſo the Contemplation of them has been thought too inconſiderable to be regarded. But when I conſider, how much moſt of the Qualities of Bodies, and conſequently their operations depend upon the ſtructure of their minute, and ſingly inviſible, particles, and that to this latent contexture, the bigneſs the figure and the collocation of the Intervals and Pores do neceſſarily concur with the Size, Shape and Diſpoſition or contrivance of the ſubſtantial parts I cannot but think the Doctrine of the ſmall Pores of Bodies, of no ſmall importance to Natural Philoſophy. And I ſcarce doubt, but if ſuch little things had not eſcaped the ſight of our Illuſtrious *Verulam*, he would have afforded a good Porology (if I may ſo call it) a place,(and perhaps not the loweſt neither,) among his *Deſiderata*.

And, *though* other imployments and avocations hinder me from attempting to treat of this ſubject as amply and particularly as it deſerveth, or even as I had deſign'd in a Scheme drawn diverſe years ſince, and ſeen by ſome *Virtuoſi*; *Yet*, not to leave a part of Phyſicks, that ſeems to me ſo curious and important, altogether as uncultivated as I found it; I ſhall preſent you as many of the Notes I had drawn together about this ſubject, as I can conveniently (for I do not pretend to do it methodically) reduced to three heads: Whereof the firſt, which will challenge to it ſelf this preſent eſſay, is the *poroſity of Animal Bodies*, about which I ſhall not be ſolicitous to marſhal my obſervations, ſince they all conſpire to ſhew but this one thing; That the parts of Animals, eſpecially whileſt theſe are alive, are furniſhed with numerous Pores.

Thoſe parts of the Bodies of Animals, wherein their poroſity may be beſt ſhewn ſeem to be their Membranes or Skins, the Bones, the Fleſh, and Coagmentations of Membranes, Fleſh and Juices. And therefore it would be proper enough to treat of theſe Heads diſtinctly, and give Inſtances of each of them in particular. But yet I think it will be more convenient, to ſet down in order the principal Fountains, whence the Porouſneſs of the ſubſtances belonging to the Animal Kingdom (as the Chymiſts ſpeak) may be derived, and to annex to each of theſe the Experiments and obſervations, upon which I argue from it, and which it will be eaſy to refer, if that be thought fit, to this or that of the parts above mentioned (namely the Membranes, Bones, &c.) whereto they ſhall (reſpectively) appear the moſt properly to belong.

CHAP. I.

THe firſt thing from which I will deduce the Poroſity we have been ſpeaking of, is, the Frame or Conſtitution of the ſtable Parts of the Bodies of Animals. For the Body of an Animal being not a rude and indigeſted lump of matter, but a curious engine, admirably framed and contrived for the exerciſe of ſeveral Functions as Nutrition, Generation, Senſation, and many differing local Motions, it was neceſſary that it ſhould be furniſhed with variety of Diſſimilar and Organical parts not only very Skilfully, but very differingly, contrived congruous to the ſeveral uſes for which they were deſigned, or if you pleaſe, to the ſeveral Functions they were to perform. And, becauſe 'twill be eaſily granted, that the Corpuſcles, that are skilfully brought together for ſuch purpoſes, muſt be ſo contexed as not to touch one another exactly every where, it will readily follow that they muſt leave little Intervals or Pores between them, and that, conſidering the multitude of particles that muſt go to the making up the Body of the Animal, and the great difference and variety in point of bigneſs and figure of the Corpuſcles that are requiſite to contex ſuch differing parts, as Membranes, Fibres Bones, Grizles, Ligaments, Veins, Arterys, Nerves, &c. Both the number and the variety of the Pores cannot but be very great. This argument will be much confirmed, by what there will be occaſion to ſay further to the ſame purpoſe, in the Eſſay touching the Poroſity of even Solid Bodies. Wherefore I ſhall now proceed to the Second thing, whence we may derive that of Animal Subſtances.

CHAP. II.

THis is afforded us by conſidering the Nutrition of Animals. For there being continually a great waſte made of their ſubſtance, partly by the excluſion of viſible excrements, and partly by the avolation of inviſibles ſteam, this great loſs muſt neceſſarily from time to time be repairpaired by the ſupplies afforded by Nutrition of which the beſt, if not the only Intelligible, way of giving an account, is, to conceive that the alimental Juice, prepared chiefly in the Stomach is impelled or attracted (for to our preſent purpoſe it matters not which) to the parts of the Body that are to be nouriſhed by it, and the Corpuſcles of the juice inſinuate themſelves at thoſe Pores they find commenſurate to their Bigneſs, and Shape; and thoſe that are muſt congruous, being aſſimilated, add to the ſubſtance of the part wherein they ſettle, and ſo make amends for the Conſumption of thoſe that were loſt by that part before. This may be illuſtrated by what happens in Plants, and eſpecially Trees, in which, of the various Corpuſcles that are to be found in the liquors, that moiſten the Earth, and are agitated by the heat of the Sun and the Air, thoſe that happen to be commenſurate to the Pores of the Root, are by their Intervention impelled into it, or imbibed by it, and thence conveyed to the other parts of the Tree in the form of Sap which paſſing through new ſtrainers, (whereby its Corpuſcles are ſeparated, and prepared or fitted to be detained in ſeveral parts) receives the alterations requiſite to the being turned into Wood, Bark, Leaves, Bloſſoms, Fruit, &c. But to return to Animals, our argument from their Nutrition will be much confirmed, by conſidering, that in Children and in other young Animals, that have not yet attained their due Stature and Bulk, the Nutrition is ſo copious as to amount to a continu'd Augmentation. For, as 'tis evident that Animals grow in all their parts, and each part according to all its Dimenſions, in ſo much that even the cavities of Bones increaſe; ſo we cannot well conceive how this can be done, unleſs the Nutritive liquor be diſtributed through the whole Body of the part that is to be nouriſhed and augmented. And to this diſtribution 'tis requiſite that the Body abound with Pores into which the congruous particles of the Juice may be intimatly admitted, & penetrating even into the innermoſt receſſes, may place or lodge themſelves in the manner that is moſt convenient for the Natural Increaſe of the part. But the more particular Declaration of this Proceſs I leave to Anatomiſts and Phyſicians.

CHAP. III.

HAving premis'd once for all, that in this Eſſay, I often uſe the word Skin in the lax and popular ſenſe of it, without nicely diſtinguiſhing the *Epidermis* or *Cuticula*, called in Engliſh the *Scarf-skin*, from the *Cutis* it inveſts and ſticks cloſely to; I ſhall proceed to another Topic, whence the Porouſneſs of Animals may be argued, namely, the great plenty of matter that is daily carried off by Sweat, and inſenſible Tranſpiration. For, 'tis confeſt that Sweat is diſcharged at the Pores of the skin; and ſince there is no penetration of Dimenſions, we may ſafely conclude, that the matter that is not waſted by Sweat, or by any other ſenſible way of evacuation, muſt have ſmall Pores or out-lets in the Skin, at which it may iſſue in the form of ſteams; though nothing hinders but that inviſible *Effluvia* alſo may evaporate at the ſame Pores with the Sweat, though for want of plenty or groſſneſs, or a fit diſpoſition in the ambient, thoſe Effluvia be not at the Orifices of thoſe Pores brought into little Drops, ſuch as thoſe of ſweat.

That therefore the Skins of a multitude of Animals, though they ſeem cloſe to the eye, may be porous, may (as we have been ſaying) be argued in many of them from their ſweating. But becauſe all of them have not been obſerved to ſweat, as is wont to be particularly affirmed of Dogs, we ſhall add ſome other Inſtances to make it probable.

We may ſometimes, in the ſmooth skin of a living man, diſcern Pores with good Microſcopes, and, with one that is none of the beſt, we may eaſily on the inſide of gloves, which are made but of skins dreſt, diſcern good ſtore of theſe little out-lets: Sometimes orderly enough ranged to make the ſight not unpleaſant. And though ſome of them may, I think, be ſuſpected to have been made by the Hairs that grew on the skin before 'twas dreſt, yet that greater numbers of them, than can be ſuppoſed to come from thence, are perforations that paſs quite through the Leather, may, not improbably, be ſhewn by the uſual Practice of Chymiſts, to purify Quick-ſilver by tying it up ſtrictly in a piece of kids or ſheeps Leather, and then wringing it hard to force it out; by which means the lower ſurface of the Leather will be covered with a Mercurial Dew or Sweat which will fall down and fly out, as the Pores happen to open this or that way, in a thick ſhower of globules, leaving the droſs behind in the Leather. And tho when a mans skin is tanned it is of a greater thickneſs then one would expect, and that which I employed ſeem'd almoſt as thick as a Buck-skin Glove yet having had the curioſity to try the ſame Experiment with the skin of a mans Arm, I found the Quick Silver would be ſqueez'd out at the Pores of that alſo. 'Tis not neceſſary that I ſhould here inquire, whether the little holes, unperceiv'd by the naked Eye, at which the Sweat is diſcharged, and perhaps the matter that the Body looſes by inſenſible tranſpiration gets out, be not, at leaſt moſt of them, the Orifices of ſmall excretory veſſels, belonging to thoſe very numerous glandules which the excellent Anatomiſts *Steno and Malpighi* are ſaid to have diſcovered beneath the *Cuticula*, and which for their ſmalneſs and ſhape have been called *Glandulæ miliares.* I need not, I ſay, engage in this inquiry, ſince according to this ingenious opinion alſo, the Skin muſt be allow'd a multitude of ſmall Perforations or Pores, and that is ſufficient for my purpoſe, from whenceſoever this Poroſity proceeds in a mans Skin. For the next obſervation will ſhew that ſome membranes of Animals may give paſſage to tranſpir'd matter without being perforated by the excretory Veſſels of Glandules.

The Membranes or Skins under the ſhells of Hens Eggs, though they be very thin, are of a Contexture very fine and cloſe as may be confirmed by their reſiſting the ſharp Corpuſcles of Vinegar; and yet, that not only theſe Skins, but the ſhells that cover them, are porous, may be inferred from the Experiments I made, of keeping them ſuſpended for a good while, and carefully counterpoiſed in good ſcales;

for by theſe it appeared, that the Eggs did from time to time manifeſtly loſe in weight; which could not reaſonably be imputed but to an inviſible Tranſpiration, the rather, becauſe uſually in eggs that have been kept long, there will be at one end a cavity which is wont to increaſe with their age, and is made by the ſhrinking of the Membrane from the Shell, to accommodate it ſelf to the diminiſhed quantity of matter, that remains to be involved by it.

When I conſider the plenty of matter, that is wont to be diſcharged daily by inſenſible Perſpiration, eſpecially in Healthful men that exerciſe themſelves moderately, I cannot but think it probable, that the minute Pores, that ſuffice for the carrying off ſo much matter, are very numerous, and are much more ſo than even by the multitude of drops of ſweat, that ſerve to wet the skin, men are wont to imagine. For *Sanctorius* in his excellent little Tract *de Medicina ſtatica* affirms, that what is barely carryed off by inſenſible tranſpiration does ordinarily amount to more, that is, diminiſhes more the weight of a mans Body, than all the viſible excrements (whether groſs or liquid) put together. *Aph. vi.* He adds, If the meat and Drink, taken in one day, amount to the weight of eight pound, the inſenſible Tranſpiration ordinarily amounts to five pounds or thereabouts. And elſewhere ſays, that ſometimes in the ſpace of 24 hours, in the Winter time, a healthy Body may exhale fifty ounces or more. And ſome Tryals, that I have carefully made upon my ſelf, added to ſome others of a very curious as well as great Prince, that made uſe of a like inſtrument, & did me the honour to acquaint me with the events, gave me no cauſe to reject *Sanctorius*'s obſervations, conſidering the difference in point of heat, between the climate of *Italy*, where he writ, and that of *England*, where ours were made; only I fear, there has been committed an overſight by thoſe many that aſcribe all the decrement of weight, that is not referrable to the groſſer Excrements, to what tranſpires at the Pores of the viſible parts of the skin, without taking notice of that great plenty of ſteams that is in expirations diſcharged through the Wind-pipe by the Lungs, and appear manifeſt to the Eye it ſelf in froſty weather; though they may be preſumed to be then leſs copious than thoſe Inviſible ones that are emitted in Summer, when the ambient Air is much warmer. But *though* I look upon the Wind-pipe as the great Chimney of the Body in compariſon of thoſe little Chimneys (if I may ſo call them) in the Skin, at which the matter that is waſted by perſpiration is emitted, *yet* the number of theſe little vents is ſo very great, that the fuliginous Exhalations that ſteal out at them, cannot but be very conſiderable. Beſides that, thoſe that are diſcharged at the *Aſpera Arteria*, do probably, at leaſt for the moſt part, iſſue out at the latent Pores of the Membranes that inveſt the Lungs; which membranes may be lookt upon as external parts of the Body, in reference to the air, tho not in reference to our ſight. But, to return to our Eggs, we may ſafely allow a very great evacuation to be made at the Pores of the skin in man, who is a ſanguineous and hot Animal, ſince we ſee that even Eggs, that are ſtill actually cold, tranſpire. And I elſewhere mention the copious tranſpiration even of Frogs, that are always cold to the touch; and the Decrement in weight of ſome Animals, ſoon after they are ſtrangled or ſuffocated, when, their vital Heat being extinct, no more fumes are emitted by expirations at the wind-Pipe: To which ſigns may be added the trivial experiment of holding in warm weather the palp of ones Finger, as near as one can without contact, to ſome cold & ſolid ſmooth body, as to a piece of poliſhed Steel or Silver; for you will often times ſee this Body preſently ſullyed or overcaſt, with the inviſible ſteams that iſſue out of the Pores of the Finger, and are by the cold and ſmooth ſurface of the Body condenſed into viſible ſteams, that do as 'twere cloud that ſurface, but upon the Removal of the Finger, quickly fly off, and leave it bright again.

The Perviouſneſs of the skin outwards may not improbably be argued from the quickneſs wherewith ſome Medicines take away ſome black and blew Diſcolorations of the skin, that happen upon ſome lighter ſtroke, or other contuſions. For, ſince theſe preternatural and unſightly colours are wont by Phyſicians to be imputed to ſome ſmall portions of blood, that upon the contuſion is forced out of the capillary veſſels that lye beneath the ſurface of it, & being extravaſated are obliged to ſtagnate there; it ſeems very likely, that if a powerful Medicine do quickly remove the diſcoloration, that work is performed by attenuating, and diſſolving, and agitating the matter, and diſpoſing it to tranſpire through the cutaneous Pores, though perhaps, when 'tis thus changed, ſome part of it may be imbibed again by the Capillary Veſſels, and ſo by the circulation carryed into the maſs of Blood. Now, that there are Medicines that will ſpeedily work upon ſuch black and blew marks, the Books and Practice of Phyſicians and Chirurgeons will oblige us to admit. *Helmont* talks much of the great vertue of white Briony root in ſuch caſes. And a notable Experiment made a while ago by a Learned acquaintance of mine in an odd caſe, did not give *Helmont* the Lye. And I know an eminent Perſon, who having ſome while ſince received a ſtroke, by a kick of an Horſe, on his Leg, a very threatning contuſion, which made the part look black and frightful, he was in a few hours cured of the pain of the hurt, and freed from the black part of the Diſcoloration by the bare application of the chopt leaves of Hiſſop mixt with freſh Butter into the form of a Pulteſs.

Nor is it only the Skin that covers the viſible parts of the Body that we judg to be thus porous, but in the Membranes that inveſt the internal parts, we may reaſonably ſuppoſe both numerous and very various Pores, according to the exigency of their peculiar and different Functions or Offices. For, the two firſt cauſes of Poroſity mention'd in this Eſſay, are as well applicable to the Membranes that cover the internal parts, as the Liver, the Spleen, *&c.* as to the external Skin, or Membrane that covers the Limbs; and in ſome reſpects the tranſpiration through ſuch Pores ſeems more advantaged, than that through the Pores of the ſurface of the Body; ſince the parts that environ the Spleen, Liver, Kidneys, *&c.* in man, are hot in compariſon of the ambient Air, and being alſo wet, which the Air is not, the laxity of the Pores of the internal parts is doubly befriended. And perhaps it may be allowable to conceive, both the Skin that covers the Limbs, and the Membranes that inveſt the internal parts of the Body, to be like worſted ſtockings, Waſt-Coats, *&c.* Which in their ordinary ſtate have a kind of continuity, but upon occaſion can have their Pores every way enlarged and ſtretched, in this or that manner, as the Agents that work on them determine them to be. This may be confirmed, by what we manifeſtly ſee in the finer ſort of leather, as that of Kid or Lamb, and by the latent Pores that may be opened in Sheeps Leather, and mans Leather, by the preſſure of included Quick-Silver.

This Poroſity of a living mans Skin and other Membranes, though internal ones, will the more eaſily be aſſented to if it appear that ſuch thick and groſs Membranes, as the urinary bladders of dead Animals, are Porous and Penetrable even by Water. This we tryed, by putting ſome ſalt of Tartar in a clean well dryed bladder (which ought to be afterwards tyed up cloſe in the neck, leſt the effect ſhould be aſcribed to the moiſt Air) and leaving the lower part of the bladder, as far as the Salt, reached immerſed in common Water, whoſe particles by degrees inſinuated themſelves into the Pores of the bladder, in plenty enough to reſolve the Salt of Tartar into a liquor. And, that it may not be ſaid that the Acrimony of the Salt, by fretting the bladder, made way for the Corpuſcles of the Water, I ſhall add that the Experiment ſucceeded, but much more ſlowly, when we tryed it with Sugar inſtead of Salt of Tartar. And there are ſome, who pretend that certain Syrups, made this ſlovenly way, which they would have paſs for a ſecret, are very much preferable to thoſe made of common Water.

That the films that line the ſhells of Eggs are of a very cloſe Contexture ſeems probable, as by other things, ſo by their reſiſting ſome liquors, ſharp enough to corrode the ſhell, and yet that ſuch Membranes are pervious to Liquors that are none of the moſt ſubtile of all, we found by the enſuing Experiment. This was made by taking an ordinary Hens Egg, and keeping it for two or three days in diſtill'd Vinegar, or in ſtrong crude Vinegar. For then taking it out of the Liquor and wiping it well, it was viſibly, and not inconſiderably, ſwell'd, which I concluded to be from the ingreſs of ſome particles of the liquors, at the Pores of the Skins that inveſt the White of the Egg. For we found nothing broken, though we made the Tryal more than once. And to be ſatisfied that the manifeſt expanſion proceeded from ſome other cauſe, than the meer dilatation of the White, or Yolk, or both, we compared the weight of the Egg, after it was taken out and well wiped, with that which had been taken before 'twas put into the *Menſtruum*, and found the Egg, notwithſtanding the loſs of the Shell, to be conſiderably heavier than 'twas before its immerſion.

I ſhall add on this occaſion that by a more unlikely way than that newly recited, both the Egg, Shell and Lining of an Egg, may be penetrated. For, notwithſtanding the fine and cloſe contexture of the Membranes that inveſt the Eggs, the *Chineſes* have a way of Salting them in the ſhell, as I have been aſſured both by Engliſh and Dutch Merchants trading to the Eaſt *Indies.* And in one of the Dutch Journals ſent by the Council of *Batavia* to their Principals in *Holland*, and intercepted by an Engliſh man of War, I met with divers accounts of great numbers of ſalted Eggs, that were ſuch or ſuch a day of ſuch a Month brought in by Sea to *Batavia* or other Ports. Long after which time, meeting with an ingenious Phyſician, that liv'd in *Batavia*, I learned by enquiry from him, that 'tis very true that ſuch Eggs are frequently met with in thoſe parts; he having divers times eaten of them there; ſome that he judged to have been either boyled or roaſted, before they were ſalted; and others that were raw, when they came to be dreſſed for him, but yet retained a Briny taſt. And, though the Merchants I enquired of could not tell me what way the *Chineſes* employed to Salt their Eggs, without making them unfit for common uſe, yet by a tryal made with clay and Brine, in which I kept the Eggs for a competent time, I was perſwaded that 'twas poſſible the *Chineſes* ſhould have the Art aſcribed to them. For upon the breaking of an Egg coated with clay, after it had lain for a competent time in Brine, I found its Taſt conſiderably Salt, but was, by I know not what accident, hindered from proſecuting the Experiment, and endeavouring to make it more practicable and uſeful.

I knew a Phyſitian of more learning than vertue, who, being tormented with a violent and obſtinate Colic of a peculiar kind, was wont to relieve himſelf by Cliſters of Sack; thô he uſually found that not long after he had taken any of them, they would make him giddy, and fuddle him, as he himſelf confeſſed to me. But upon this Inſtance I lay not much weight, and leſs upon what was anſwered me by a great Chirurgeon, who having practiſed his Art in the *Weſt-Indies*, and being asked by me whether he had not dreſſed Wounds and Ulcers with the recent juice of Tobacco (a plant I uſe to keep growing in my Garden for its excellent vertues in cuts, burns, and tumors;) and whether, if he employed it, he did not find it emetick, he told me among other things, that having Divers times dreſſed with this Juice a ſmall Ulcer in a Womans leg, the patient ſoon after the application would grow ſick, and have her ſtomack turned, or actually vomit. But, as I was ſaying, on this inſtance I lay no ſtreſs, becauſe the Corpuſcles of the Tobacco might probably enough get in at the ſmall Orifices of ſome corroded Veſſels, and ſo be conveyed inwards, rather by the help of the Circulation of the blood, than on the account of the Porouſneſs of the Parts. And therefore I ſhall rather mention what has been related to me, by an eminent Phyſician of the famous Colledge of *London*, namely, that he had divers times given himſelf a vomit, by a certain application of decocted Tobacco to his wriſts, and ſome other external parts; which brings into my mind, what is affirmed to have been obſerved in ſome Children that have ſcabb'd Heads, who have been made Drunk, by the application of Clothes or ſpunges wetted in Infuſion of Tobacco, or of ſtrong Liquors, and applied to the part affected. Though in this caſe the inebriating Particles may be ſuſpected to have got in, not at the meer Pores, but rather at the Orifices of the Capillary Veſſels, that were made acceſſible by ſuch little ſolutions of Continuity, as are ſeldom wanting in ſcabbed Heads.

That Children may be purged by outward applications is aſſerted by ſome Phyſicians; and an experienced Perſon of that number has affirmed to me, that he can almoſt conſtantly do it by a Plaiſter. But 'tis more conſiderable what was related to me by an eminent *Virtuoſo*, who being indiſpoſed to believe ſuch things a while before he told me the ſtory, was deſired by a curious Perſon to ſhew him his Hand which the Relator having done the other took it in his hand, which was moiſtened (as was afterwards confeſſed) with a kind of ſubtile Chymical Oil, but ſo ſlightly, that the Relator ſcarce minded it, till ſome time after when he found himſelf preſt with a motion, like that which a purge would have given him; for the other thereupon ſmiling, my acquaintance began to ſuſpect what the matter might be, and was in a ſhort time purged four times, without griping, or other pain or diſcompoſure. But to return to the Porouſneſs of Membranes, it may ſerve to make way for your admitting it, to obſerve, that *though* Lute-ſtrings be but Ropes of Fibres (which are at leaſt the chief parts that Membranes conſiſt of) dead, cold and ſtiff, *yet* when the lute is in tune they will ſometimes in wet weather ſwell ſo forcibly as with noiſe and violence to break, which proceeds from the copious ingreſs of moiſt vapors into their Pores, whereby they are not only ſhortened, but as I have tryed in nice ſcales, made manifeſtly heavier.

The Poroſity of the internal parts of Animals by both the forementionʼd ways (*viz.* of emiſſion and reception of Corpuſcles,) may be confirmed by the things that happen in ſome of the *Metaſtaſes* or Tranſlations (as the Phyſitians call them) of the morbifick matter in diſeaſed Bodies. ’Tis known to them that are any thing converſant with Hoſpitals, or the obſervations of Phyſicians, that there do not ſeldom occur in Diſeaſes ſudden Removes of the matter that cauſed them, from one part to another according to the nature and functions of which, there may emerge a new Diſeaſe, more or leſs dangerous than the former, as the invaded part is more or leſs noble. Thus oftentimes the matter, which in the ſanguiferous Veſſels produced a Feaver, being diſcharged upon ſome internal parts of the Head, produces a *Delirium* or *Phrenitis*; in the latter of which I have ſomewhat wondered, to ſee the Patients Water ſo like that of a Perſon without a Feaver; the ſame

Febril

Febrile matter either by a deviation of Nature, or medicines improper or unskillfully given, is diſcharged ſometimes upon the *Pleura*, or Membrane that lines the ſides of the Cheſt; ſometimes upon the throat; ſometimes upon the Guts; and cauſes in the firſt caſe a Pleuriſie, in the 2d a Squinancy, and in the third a Flux, for the moſt part dyſenterical. But, becauſe I ſuppoſe, that many, if not moſt, of theſe tranſlations of peccant humors, are made by the help of the circulation of the Blood, I forbore at the beginning of this Section to ſpeak in *general terms*, when I mentioned them in reference to the Porouſneſs of the internal parts of the Body, and contented my ſelf to intimate, that *ſome* of them may ſerve to confirm that Poroſity.

This will not perhaps ſeem improbable, if we conſider that 'tis in effect already proved, by the ſame arguments by which we have ſhewn, that both the Skin and the internal Membranes are furniſhed with Pores, Permeable by Particles whoſe Shape and

Size are correſpondent to them. For we may thence probably deduce, that when a morbifick matter, whether in the form of Liquor, or of exhalations, chances to have Corpuſcles ſuited to the Pores of this or that part of the Body, it may, by a concourſe of Circumſtances, be determined to invade it, and ſo diſlodge from its former receptacle, and excite Diſorders in the part it removes to.

CHAP. IV.

ANother thing whence the Poroſity of Animals may be argued, is, their taking in of *Effluvia* from without. For theſe cannot get into the internal parts of the Body, to perform their operations there, without penetrating the Skin, and conſequently entring the Pores of it.

Now, That things outwardly applyed to the Body, may without wounding the Skin, be convey'd to the internal parts, there are many things that argue.

And firſt, it has been obſerved in ſome Perſons, (for all are not equally diſpoſed to admit the action of particular Poyſons) that *Cantharides*, being externally apply'd by Chyrurgions or Phyſicians, may ſoon, and before they break the Skin, produce great diſorders in the Urinary Paſſages, and ſometimes cauſe bloody Water. And I remember, that having once had a bliſtering Plaiſter, applyed by a skilful Chyrurgion between my ſhoulders, though I knew not that there were any *Cantharides* at all mixt with the other Ingredients, yet it gave me about the neck of my Bladder one of the ſenſibleſt pains I had ever felt, and forced me to ſend for help at a very unſeaſonable time of night.

The Porouſneſs of the Skin may be alſo argued from divers of the effects even of Milder Plaiſters. For, though ſome Plaiſters may operate as they cloſely ſtick to the Skin, and hinder Perſpiration from within, and fence the part from the external cold; yet, twill ſcarce be denied, that many of them have notable effects upon other accounts, whereof none is ſo likely and conſiderable as the copious ingreſs of the Corpuſcles of the Plaiſter, that enter at the Pores of the Skin, and being once got in, act according to their reſpective Natures & Vertues. The like may be ſaid of Ointments, whoſe operations, eſpecially on Children (whoſe Skin is ordinarily more ſoft and lax) are ſometimes very notable. And I have known conſiderable things performed by them, in an internal Diſeaſe of grown men, where I ſhould ſcarce have expected a Vegetable Ointment ſhould perform ſo much: I ſay, a Vegetable Ointment, for 'tis vulgarly known that by Mercurial Ointments Salivation may be excited; and ſometimes, againſt the Phyſitians will, the Corpuſcles of the Quick Silver get ſo far into the Body, that he is not able to get them out again.

What we lately ſaid of Plaiſters, may be applyed to thoſe that Phyſitians call *Pericarpia*, or Wriſt-bands:

The better ſort of which, though ſometimes ineffectual, are oftentimes ſucceſsful in ſtopping Fits of Agues, as I have frequently found in a mixture, elſewhere mention'd, of Currans, Hops, Bayſalt well beaten together, by which, by Gods bleſſing, many, and I among others, have been freed from ſimple Tertians, and either double Tertians or Quotidians.

The Argument of the Poroſity of Animals, drawn from thoſe things that get in through their skins, without breaking or wounding them, may be much ſtrengthned, if it can be made appear, that thoſe Phyſitians do not deceive us, who aſcribe ſenſible Operations and Vertues, to things externally applyed, in ſo looſe a way, that they do not ſo much as ſtick to the Skin, or perhaps immediately touch it; ſuch as ſome call *Periapta* and *Appenſa*; divers of which are beſt known among us, by the name of Amulets; ſuch as are the Quills containing Quick-ſilver or Arſenick, that ſome hang about their necks, and wear under their Shirts, againſt the Plague and other Contagious Diſeaſes; and the Bloodſtones that others wear againſt Hæmorrhages; and the ſtone which the Women uſe in the *Eaſt-Indies*, for a quite contrary effect, in *Obſtructione Menſium*. That many of theſe external Medicines, anſwer not the promiſes of thoſe that extol them, having ſome of them no ſenſible operation at all, and others no conſiderable one, experience has aſſured judicious obſervers; but that ſome of them, eſpecially on ſome Patients, may have conſiderable, not to ſay admirable, operations, I confeſs my ſelf by other motives, as well as Authority, to be perſwaded. Having been one ſummer frequently ſubject to bleed at the Noſe, and reduced to imploy ſeveral remedies to check that diſtemper; that which I found the moſt effectual to ſtanch the blood, was ſome moſs of a dead mans Scull (ſent for a preſent out of *Ireland* where 'tis far leſs rare than in moſt other Countrys) though it did but touch my skin till the herb was a little warm'd by it. And though I remember not that I have known any great matter done to ſtop Hæmorrhagies by the bare outward application of other Blood-ſtones; yet of one that look'd almoſt like an Agate, I admired the effects, eſpecially upon a young and extraordinarily Sanguin perſon. To which I ſhall add a memorable thing, communicated to the experienced *Zwelfer* by the chief Phyſitian of the States of *Moravia*. For this learned man whom he extols for a great Phyſician and Philoſopher; aſſures him, that having prepared ſome Trochiſchs of Toads according to *Helmonts* way, (which I remember I alſo was ſolicitous to prepare, but had not occaſion to make tryal of their vertue,) he not only found, that being worn as Amulets they preſerved him and all his Domeſticks, and Friends, from the Plague (though he daily viſited the infected) but that having cauſed theſe

If one would ſee this paſſage at large he may find it at the end of the Eſſay.

Trochiſchs to be put upon the Plague ſores of ſeveral perſons, none of them died, but the venom of the peſtilential Carbuncles was thereby ſo weakened that the ulcers were afterward eaſily cured by vulgar remedies.

And now, as to the difficulty, which I acknowledge not to be ſmall, to conceive how Bodies actually cold can emit *Effluvia*, capable of penetrating (without moiſtening it) a Membrane of ſo cloſe a Contexture as a mans Skin; I ſuppoſe it will be much leſſened in the objectors opinion, by what he will meet with hereafter about the Pores of Bodies, and the Figures of Corpuſcles. For ſuppoſing theſe to be congruous, it will not ſeem incredible, that the *Effluvia* of Amulets ſhould in tract of time get paſſage through the Pores of the Skin of a Living Body. And to make this the more probable, I will give an Inſtance in the Skin of a dead *Animal.* And, becauſe this requires a Liquor I much employ in theſe trials about Porology, though I have many years ſince in

hoff. d. of authors tractate. of simple medicines. §. 6. p. m. 195

another Tract taught how to make it for another purpoſe; yet I ſhall here repeat, that 'tis made by exactly mingling Flower of Brimſtone, powdered *Sal Armoniac* and good Quicklime in equal quantities, ſave that, if the Quicklime be not very dry and good, a fourth or fifth part muſt be ſuperadded, for theſe being nimbly mixed, and diſtilled by degrees of Fire in a Retort, till the Sand be at length brought to be almoſt red hot, there will come over a ſmoaking Spirit, which muſt be kept very carefully ſtopt, and which for diſtinctions ſake, I alſo uſe to call, The *Permeating Menſtruum, or Liquor*, and its expirations the Penetrant, or Permeating Fumes.

And now you will eaſily underſtand the experiment I was about to mention, which was this; We took a very clean piece of poliſh'd Copper, in want of which one of ſilver will ſerve the turn, and having lapt it up in a piece of either Lambs or ſheeps Leather, ſo that it was every way incloſed, we then held it over the Orifice of the Vial that contained the Spirit, at a pretty diſtance from the Liquor, whoſe fumes nevertheleſs did quickly, (perhaps in a minute of an hour or leſs) pervade the Pores of the Leather, and operate upon the included metal as appeared by the deep and laſting tincture it had given to the lower ſurface of it, though the interpoſed Leather it ſelf was not deprived of its whiteneſs, nor at all ſenſibly diſcoloured; however it ſmelt of the Sulphureous ſteams that had invaded it. And, if I miſremember not, the ſame Experiment ſucceeded, though ſomewhat more ſlowly, when a double Leather was interpoſed between the fumes and a new piece of Copper coin. This will be thought the leſs ſtrange, when I ſhall come to ſome other Inſtances of the Penetrancy of theſe Spirits. In the mean while I leave it to be conſidered, whether this may not ſuggeſt ſome conjecture at that ſtrange *Phænomenon*, which is recorded by Authors of good repute, That ſometimes in great Thunders the Lightening, among other operations, has been found to have manifeſtly diſcoloured mens money, without burning the Purſes or Pockets wherein it lay. For in our experiment, the ſteams that in a trice pervaded the Leather, the moſt uſual matter whereof Purſes are made, were ſulphureous, as the ſmell argues, that thoſe which accompany the *Fulmen* are wont to be; and whereas theſe, when they invade Bodies, are uſually very hot, ours operated when the Liquor that emitted them was actually cold. And if it be ſaid, that ſometimes their money has been found diſcolored in their Pockets, who were not ſtruck, by the *Fulmen*, but had it only paſs near them, it may be objected, that tho the intire Body, whether fluid or ſolid, if there be any of this latter kind that is in Latine called *Fulmen* (for our Engliſh word, *Thunderbolt* ſeems not ſo applicable to a fluid) did not touch them, yet it might ſcatter ſteams enough round about it, to cauſe the *Phænomenon.* For confirmation of which I ſhall take notice, that a conſiderable Perſon of my acquaintance, having had the Curioſity to aſcend a burning mountain in *America*, till the ſulphureous ſteams grew too offenſive to him, he told me that, among other operations he obſerved them to have upon him, one was, that he found the money he had about him turned of a black and dirty colour, ſuch as I have obſerved our ſulphureous ſteams often give both to Copper, and to Silver Coins. But whether or no our Spirits will juſtify the conjecture, they invited me to mention, at leaſt their ſo eaſily pervading the Skin of a dead Animal may make it probable, that the Skin of a Living man may be eaſily penetrated by external ſteams whoſe approach the Eye does not perceive, and whoſe operations, though not inconſiderable, may therefore be unſuſpected. I leave to Phyſitians to conſider, what uſe may be made of this obſervation, in reference to the propagation of contagious Diſeaſes, by the contact of infected Air, diſtinct from the Reſpiration of it, and by the penetration of the ſteams, that iſſuing from divers Bodies invade the Skin, and may perhaps be capable of operations, either hurtful or friendly, that are not uſually ſuſpected to proceed from ſuch cauſes, and are therefore miſaſcribed to others. And on this occaſion it will not be impertinent to add, that by hanging up ſheeps Leather or Lambs Leather in the free Air, the vapors of it would ſo inſinuate themſelves into the Pores in wet weather, that a moderate degree of moiſture in the Air would add to it a not inconſiderable weight, of which dry weather, whether hot or cold, would deprive it.

CHAP. V.

I Muſt not in this place omit ſome Inſtances, very proper to manifeſt the Penetrableneſs of Membranes to Fumes themſelves, if they be ſubtile enough for their Pores, or correſpondent enough to them.

Among the obſervations publiſhed by Phyſicians I have met with ſome by which it appears that *Cantharides* may have great Effects upon the internal Parts of the Body, though they do not ſo much as touch the Skin, but are placed at ſome diſtance from it, ſo that their *Effluvia* muſt be tranſmitted through other Bodies before they can penetrate that. The learned *Michael Paſchalius* mentions a Chyrurgion, who was twice brought to void much Blood with his Urine, by ſome Spaniſh Flies that he carryed about in a Purſe or Bag. And another Doctor of note relates of another perſon that came to complain to him, that he piſſed Blood, having carryed about with him *Cantharides*, though in his Pocket, and adds, that a like Caſe was recounted to him by *Helidæus*, whom he calls an eminent *Bolognian* Phyſician.

Schenkii Obſervationum, Lib. 7. Obſ. 37.

We ſee, that in Linnen Cloth, the

finer and more ſlender the threads are the cloſer and leſs Porous, *cæteris paribus*, the Linnen is: By analogy to which one may eſteem the thin film that lines the ſhell of an Egg, to be of an exceeding cloſe Contexture; and yet that even this film is not impervious to ſome Fumes, I have found by the following Tryal.

To make this, we ſlowly and warily pick'd off a ſufficient part of the Shell of a Hens Egg, from the Skin that lay juſt beneath it, and is wont to ſtick ſo cloſe to it, that their ſeparation, without injuring the Membrane, is not eaſy. In this Skin, being wip'd, we wrapt up a flat piece of Copper, whoſe ſurface was made bright, that the change of Colour might be the better ſeen; and having kept this covered bit of Plate, over the Fumes of our ſmoaking Liquor lately mentioned for a minute or two by our gheſs we unfolded the Skin, and found, as we expected, that the lower ſurface of the Copper which was it that had been held over the

Fumes, was turned of a very dark colour, which manifeſted that even ſo fine and cloſely contexed a Membrane was not only, as we have formerly ſhewn, penetrable by Liquors, but readily pervious to our ſulphureous exhalations, tho theſe were probably but faintly emitted, ſince the Liquor they came from was then actually cold. But in making the Tryal it is fit to hold (as we did in that newly recited) the Membrane againſt the light, to ſee if it be intire, and have eſcaped all thoſe little lacerations that are hardly avoidable in ſevering it from the Shell it ſticks ſo cloſe to. If this caution be neglected, 'tis eaſy to be impoſed on, by overlooking ſome little holes, that are not eaſily diſcerned when one looks down upon the Skin, and yet may be ſufficient to make the Experiment deceitful. But, thô when 'tis well made, it is a notable confirmation of the Doctrine endeavoured to be eſtabliſhed in this Paper, yet I ſhall now ſubjoyn a more conſiderable

Inſtance to the ſame purpoſe.

The Porouſneſs of the Internal Membranes of the Body, will be more eaſily granted, if it be conſidered that either the Liquors, or the moiſt Exhalations, whoſe Action is promoted by the Natural Heat of the Parts, keeps them conſtantly wet or moiſt, and thereby renders them more lax, and more penetrable by ſubtle Spirits or other Corpuſcles. In favour of this Reflection I made the following Experiment. We took a piece of a dryed Urinary Bladder, which was judged to have been a Calfs; and having lapt it about a new piece of Silver Coin, ſo that the Bladder was ſingle where it covered the lower ſide of the Piece, we kept it for divers Minutes, by gueſs, over the Spirituous Fumes of our often mentioned Permeating Liquor, but could not perceive that the Coin was thereby at all affected or terniſhed. Whence we concluded that the Pores of the dry Bladder were too cloſe and narrow, to give paſſage to the Expirations of the *Menſtruum.* But preſuming that moiſture would ſome what relax them with another piece of the ſame Bladder, made limber by being a little wetted in common Water, we lapt up another like peace of new Coin, as we had done the former, and kept it at the ſame diſtance as before, from the Liquor, but not for ſo long a time. For after about two Minutes, by gueſs, we remov'd and took out the Piece, and, as we expected, found much of its lower ſurface (that regarded the Liquor) deeply diſcoloured. Which Experiment will not only juſtify what I lately ſaid, of the greater Laxity of moiſt than of dry Membranes, but will be thought no mean confirmation of what is in this Eſſay delivered about the Poroſity of Membranes, ſince the Urinary Bladder does, as Anatomiſts well know, conſiſt of more than one Membrane, though they ſtick ſo cloſe together, as to appear but one to the Eye. And this Bladder was ſpeedily penetrated by the Fumes that our Liquor emitted in exceeding Cold and Froſty weather, though the Bladder it ſelf was not in the warm Body of the live Animal, but had been ſo long kept dryed and cold, that probably the Moiſture it introduced in ſcarce one minute of an Hour, could not reſtore it to the Laxity it had, whilſt it was a part of the living Calf.

One of the notableſt Inſtances I ever met with, of the Poroſity of the Internal Membranes of the Humane Body, was afforded me by that *Britiſh* Nobleman, of whom our famous *Harvey* tells a memorable, not to ſay matchleſs, ſtory. This Gentleman, having in his youth, by an accident which that Doctor relates, had a great and laſting Perforation made in his *Thorax*, at which the motion of his Heart could be directly perceiv'd did not only out live the accident, but grew a ſtrong, and ſomewhat corpulent man; and ſo robuſt, as well as Gallant, that he afterwards was a Souldier, and had the honour to command a Body of an Army for the King. This Earl of *Mount-Alexander* (for that was his laſt Title having marryed one of my neareſt kinſwomen, and having been told that I was very deſirous to ſee, what I had heard ſuch ſtrange things of, very obligingly came, at a fit time, to give me that ſatisfaction. In order to which he removed that which covered the wide Orifice of his Hurt, and gave me the opportunity of looking into his *Thorax*, and of diſcerning there the motions of the Cone, as they call it, or *Mucro* of the Heart. But theſe things I mention but upon the by, and becauſe of the ſtrangeneſs of the fact; the thing I principally intended relates to my preſent argument. Having then made ſeveral inquiries fit for my purpoſe, his Lordſhip told me, that when he did, as he was wont to do from time to time, (though not every day) inject with a Syringe ſome actually warm medicated Liquor into his *Thorax*, to cleanſe and cheriſh the

Parts, he ſhould quickly and plainly find in his Mouth the taſt and ſmell of the Drugs, wherewith the Liquor had been impregnated. And I further learned, that, whereas he conſtantly wore upon the uncloſed part of his Cheſt, a Silken Quilt, ſtuffed with Aromatick and odoriferous Powders, to defend the neighbouring Parts and keep them warm; when he came, as he uſed to do after ſome weeks, to imploy a new Quilt, the fragrant *Effluvia* of it would mingle with his Breath in exſpiration, and very ſenſibly perfume it, not, as I declared I ſuſpected, upon the ſcore of the pleaſing Exhalations that might get up between his Clothes and his Body, but that got into the Organs of Reſpiration, and came out with his Breath at his Mouth, as was confirmed to me by a grave & judicious Stateſman, that happened to be then preſent, and knew this General very well. Other circumſtances I might add, but that I dare not truſt my memory for them, and unhappily loſt the Paper, wherein the oddneſs of the things invited me to ſet them down, for fear of forgetting them.

That part of this Narrative which relates to Injections may be much confirm'd by what is delivered by *Galen* himſelf, who ſays that *Mulſum* or *Honeyed Water*, being injected at the Orifice of Wounds penetrating into the cavity of the *Thorax*, has been obſerved to be in part received into the Lungs, and diſcharged out of the *Aſpera Arteria* by coughing. And this he mentions as a known thing, imploying it as a *Medium* whereby to prove another.

The mention that has been made of the Poroſity of Membranes, brings into my mind what I once obſerved at the Diſſection, made by ſome Phyſicians, and Anatomiſts, of a luſty Souldier, that was hanged for I know not what crime. This man, though otherwiſe young and ſound, was obſerved to have been long moleſted with what they call a *ſhort, dry Cough*, which made us expect to find ſomething

thing much amiſs in his Lungs. But meeting with nothing there, we were at a loſs for the cauſe of this Cough, till coming to conſider the internal part of the Cheſt, we perceived ſomething on one of the ſides, by tracing of which we diſcovered, that between the *Pleura* and the ſubſtance of the intercoſtal muſcles, there was lodged a certain matter, of the breadth of a Silver Crown piece, or thereabouts, of a roundiſh figure, and of the conſiſtence and almoſt colour of new, ſoft Cheeſe, which odd ſtuff was concluded to have been the remains of ſome ill cured Pleuriſy, and to have tranſmitted through the Pores of the *Pleura*, though that be a very cloſe Membrane, ſome noxious *Effluvia*, which ever and anon irritated the Lungs into an irregular and troubleſom motion, and ſo produced the Cough the Malefactor had been moleſted with.

CHAP. VI.

I Am well aware that 'tis far leſs difficult, to prove the permeableneſs of ſingle Membranes, than that of ſuch a Part of the Body, as ſeems to be an aggregate of ſeveral parts, which in regard of their cloſe adheſion, are looked upon but as one part, to which, on that account, men commonly give a diſtinct name. But yet there are ſome *Phænomena* that ſeem to argue, that even ſuch compounded or reſulting parts, if I may ſo call them, are not deſtitute of Pores, which whether they be not ſome of them the Orifices of exceeding ſlender and therefore unobſerved Capillary Veſſels, I muſt not now ſtay to enquire.

When the cavity of the *Abdomen* in thoſe Hydropical Perſons that are troubled with an *Aſcites*, is filled with Water, or rather with a Liquor that I have found to be much more viſcous, it juſtly appears ſtrange, that by an

Hydragogue, or ſome appropriated purging medicine, great quantities of this groſs Liquor ſhould in a ſhort time be carryed off by Siege, and perhaps alſo by Urine, though to get into the cavity of the Guts, or that of either of the Kidneys, it ſeems neceſſary that it Permeate the Tunicles, and other component parts, of the *Viſcera* it gets into.

I know not whether I may on this occaſion take notice of what Phyſicians obſerve to occur now and then in *Empyema's* that follow ill conditioned *Pleuriſies.* For it has ſeveral times been obſerved, that upon the burſting of ſuch impoſthumes into the cavity of the Cheſt, the Purulent matter hath been voided by Siege and Urine. I heſitate, as I was ſaying, whether I ſhould alledge this *Phænomenon*, as a proof of what I now contend for, till it be determined whether this *Metaſtaſis* be made by *tranſudation* properly ſo called, or by the ingreſs of the *Pus* into the imperfectly cloſed Orifices of the Veſſels of the Lungs;

where being once admitted and mingled with the Blood they may with this circulating Liquor arrive at the Kidneys, or any other Parts fitted to make a ſecretion of this Heterogeneous matter.

But whatever be the Reaſon or manner of it, we find that the Lungs do ſometimes odly convey things to diſtant parts of the Body. And if I may here mention a thing, *cui honos præfationis eſt*, I ſhall add that I have ſeveral times obſerv'd in my ſelf, that when I had been an actor or an aſſiſtant in the Diſſection of a living Dog, eſpecially if his Blood or Body were rankly Scented, I ſhould divers hours after plainly find that odour in the excrements I voided by Siege.

A famous Chirurgeon and Anatomiſt relates, that one who was very ill of a dropſy, judged to ariſe from a *Scirrhus* of the Spleen, coming to ask his counſel and aſſiſtance, though he judged the patients caſe deſperate, yet to content him, he ordered him to dip a very large Sponge in good Quicklime-Water, and having ſqueezed out the ſuperfluous Liquor, to bind it upon the region of the Spleen, only ſhifting it from time to time. He adds, that after ſome months he was much ſurprized to receive a viſit from this Patient, with ſolemn thanks for his recovery; the outward Medicine having, it ſeems, reſolved the *Scirrhus* and concurred with nature to evacuate the hydropical humour. For the reſolution of which hard tumour it ſeems neceſſary, that the ſanative Corpuſcles of the external remedy ſhould at length penetrate, not only the *Epidermis*, and the true *Cutis*, but the Muſcles themſelves of the *Abdomen*, and ſome other interpoſed parts.

These inſtances may be ſtrengthen'd by an eminent obſervation of *Galen*, who takes notice that Bones being ſometimes broken, without piercing the Skin that covers the part they belong to, when the *Callus* is making, and the broken parts of the Bone begin to be conglutinated together, a Portion of that Blood which had flowed to the part affected is carryed to the Skin and permeats that, ſo as to wet and foul the Dreſſings or Bandages that are kept upon the limb affected by the Fracture.

CHAP. VII.

B*Ones*, *Horns*, and parts of the like Subſtance, being thoſe that are granted to be the moſt ſolid of the Bodies of Animals, I come in the laſt place to ſhew by particular Experiments that theſe alſo have their *Pores*. I ſay, by particular Experiments, becauſe in a general way, their *Poroſity* has been already proved, by the ſame Arguments, from their original Texture, Nutrition, Augmentation, *&c.* That have been employed to manifeſt the *Porouſneſs of Animal Subſtances in general*.

That the Nails of men, as well as their *Skins*, are Porous, may be gathered from their being eaſily and permanently tinged with divers metalline ſolutions, and particularly with thoſe of ſilver in *Aquafortis*, and Gold in *Aqua Regia*; the former of which ſolutions though cold, will but too eaſily tinge the Skin and Nails it chances to touch, and makes ſome little ſtay upon, with a dark and blackiſh colour; which I found not that I could waſh out with water, or, even with a far more penetrating and abſterſive liquor. The like durableneſs I found in the Purple ſpots, that I ſometimes purpoſely made on my Nails, by letting ſome little drops of the ſolution of Gold in *Aqua Regia* dry upon them, which I now and then did, to obſerve the way of the Nails growth. For if the ſtain were made near the root of the nail, it would be ſtill, though very ſlowly, thruſt on by the new matter, till after ſome weeks it arrived to the further end of the Nail, and was fit to be pared off with it. But this only upon the by. 'Tis more to our purpoſe to take notice, that, though the *Menſtruums* imployed in the recited

Experiments be of themſelves very acid and corroſive, yet they are ſo changed by the metals they have diſſolved, that they are Acid no more, the ſolution of Silver being rather extreamly bitter, and that of Gold of a kind of *Stiptic* taſt, almoſt like that which ſloes, growing in the hedges, are wont to be of.

Ivory is a thing too well known to need to be deſcribed. And, ſince 'tis generally lookt upon (for I have had no opportunity to compare it with the Bones) as the ſolideſt part of the vaſteſt of Tereſtrial Animals, Experiments proving its poroſity, will be ſtrong preſumptions for that of the hardeſt parts of other Animals. And the Porouſneſs of Ivory may be argued from the ſeveral ways of dying it with permanent colours. For in theſe colorations the Tinctures that make them, muſt penetrate into, and be lodged in the Subſtance of the Ivory, eſpecially when the Subſtance remains ſmooth and glaſſy, as I have divers times made it do, when I employed fit *Menſtruums* and Metalline Pigments. The ſolution I formerly mentioned of Silver in *Aqua fortis*, being laid upon Ivory, will ſoon give it a dark and blackiſh ſtain, which is not, that I have found, to be waſhed off. I remember alſo that I many years ſince taught ſome ingenious artificers, to adorn Ivory with a fine purple colour, by moiſtening it with, and ſuffering leiſurely to dry on it, a ſolution of Gold made in *Aqua Regia*. And if occaſion required, allayed with water, nor needs either of theſe ſolutions be applyed hot, any more than the Ivory needs to be heated. Both which circumſtances favour the Porouſneſs of the ſolid Body.

Copper diſſolved in *Aqua fortis* ſtains Ivory with a blewiſh colour, as I have ſometimes ſeen in the hafts of knifes, about whoſe coloration nevertheleſs another way is alſo employed. But I remember that without making uſe of any Acid or Corroſive *Menſtruum*, I have even in the cold ſtained Ivory, with a fine and permanent blew, like a Turquois, by ſuffering to dry upon it as deep a ſolution as I could make of Crude Copper, in an urinous Spirit, as that of *Sal-Armoniack*.

But now to return to Bones, their growth in all their dimenſions, does, as I lately noted, argue their Poroſity and the marrow that is found in the great hollow Bones, whether it nouriſh them or no, muſt it ſelf be ſupplyed by ſome alimental juice, that ſoaks or otherways penetrates, into the cavities that contain it.

Nor does it ſeem at all improbable, that Blood it ſelf may through ſmall Veſſels be conveyed into the very ſubſtance of the Bone, ſo as that the Veſſels reach at leaſt a little way in it, though perhaps the Liquor they carry may afterwards by Imbibition be brought to the more internal parts of the Bone. For not to urge that we manifeſtly ſee, that on each ſide of the lower Jaw, Nature has been careful to perforate the Bones, and make a Channel in the ſubſtance of it; which Channel receives not only a larger Nerve but a Vein, & Artery to bring in & carry back Blood for the nouriſhment of the Teeth, by diſtinct Sprigs ſent from the great branch to the particular Teeth. Not to urge this, I ſay, (which I mention but to ſhew that the opinion lately propoſed is agreeable to a known practice of Nature) I have been aſſured by eminent Anatomiſts, whom I purpoſely conſulted, that they have obſerved Blood-veſſels to enter a great way into the ſubſtance of the larger Bones. And one of them affirmed, that he had traced a Veſſel even to the great Cavity of the Bone. Which I the leſs ſcrupled to admit, becauſe it has been obſerved, that in younger Animals the Cavity is in great part furniſhed with Blood, as well as Marrow, and in thoſe larger Pores, whereof many are found in the more Spongy Subſtance of divers Bones, Blood has been obſerved to have been lodged, as alſo in the ſpongy part of the Skull, that lies between the two Tables, as I have been aſſured by Skilful Eye-witneſſes.

The blackneſs alſo, that Bones acquire when put into a competent heat, and a peculiar kind of fatneſs which they may by heat be made to afford, ſhew that they harbour, even in their internal parts, ſtore of Unctuous Particles, ſeparable from the ſolid ſubſtance, (which ſtill retains its ſhape and continues ſolid) in whoſe Pores they may thereby be argued to have been lodged. The Lightneſs of Bones, even when their Cavity is acceſſible to (Air and) Water, is alſo a great ſign of their Poroſity. And ſo is their being corroded by tinging liquors, if they be penetrative and well applyed. I know not whether I ſhould add on this occaſion, that having taken calcined and pulverized Bones, ſuch as we uſe to make our Cupels of, and, after having given them a good heat, kept them for ſome time in the Air, but in a well covered place; I found the imbibed moiſture of the Air to have manifeſtly increaſed their weight; and that I alſo obſerved in a curious *Skeleton*, where the Bones were kept together by wires, inſtead of other Ligaments, that though I kept it in a well covered place, not far from a Kitchin Fire, yet in very moiſt weather the Bones ſeemed to ſwell, ſince thoſe joynts that were eaſy to be bent, in dry weather, and that after ſeveral manners, would grow ſtiff and refractory, and indiſpoſed to be put into ſuch motions, when the weather was conſiderably wet. Theſe particulars (as I was ſaying) I am ſomewhat doubtful whether I ſhould here inſert, becauſe one may ſuſpect the *Phænomena* may proceed rather from ſomewhat elſe, than the imbibed moiſture of the Air; and yet I would not omitt to mention theſe obſervations, becauſe I do not yet ſee any cauſe to which they may more probably (or indeed ſo probably) be aſſigned.

And on this occaſion I ſhall ſubjoyn ſome obſervations made on large and ſolid Ox Bones, which in one of my Note Books I find thus regiſtred. *Nov.* 15. We weighed two [entire or unbroken]

broken] Marrow Bones, and found the one to weigh ℥xxix + ʒß, and the other ℥xxiv + ʒiv + 30 gr. *Nov.* 24. The former weighed ℥xxix + ʒvi, and the latter ℥xxv + ʒi + 30 gr. *Decemb.* 28. the former weighed ℥xxix + ʒiij. 55 gr. and the latter ℥xxiv + ʒvii. + 39 gr. *June* 7th of the following year, the former weigh'd ℥xxix + ʒii. And the latter ℥xxiv + ʒvii. By which obſervations purpoſely made at differing times of the year, and in very good ſcales, it ſeems that Bones do plentifully enough imbibe the Exhalations of the Air, and emit them again, together with ſome of their own, according as the ambient happens to be diſpoſed. And theſe alterations argue the Bones to abound with Pores, ſince the external ſteams muſt have Pores to receive them, and the *Effluvia* muſt upon their receſs leave Pores behind them.

I confeſs that to think (as with ſome Anatomiſts I lately ſeemed to do) that Bones themſelves admit into their ſubſtance, Veſſels capable of conveying a nutritive Liquor, we muſt ſuppoſe thoſe Veſſels extreamly ſlender. But that 'tis not only poſſible but ſomewhat credible, there may be ſuch, I am induced to think, by what is known to happen in that diſeaſe, which from the Country it moſt infeſts is called the *Plica Polonica*. For, tho one would think that the hairs of men are much too ſlender, to have cavities in them capable of viſible Liquors; and though I have found it very difficult, even with a good Microſcope, to perceive any cavities in the hair of a man tranſverſly cut; yet not only ſome other writers of good note, but the Judicious *Sennertus* himſelf deliver, that in this diſeaſe (of which he particularly treats) it has been obſerved, that if the Patients cauſe their intangled hair to be cut, as they ſometimes do, by reaſon of its naſtineſs or unſightlineſs, they are not only thereby endangered, but ſometimes the ſingle hairs will actually bleed, where the ends have been cut off; ſo that ſo thick a Liquor as Blood may be conveyed through Veſſels, that can at moſt be but in a proper ſenſe *Capillary* and muſt be far leſs than hairs, if their Perforations be like thoſe by which many Plants have their nouriſhment conveyed to them, or ſuch as are obvious in divers Canes, which being cut quite through transverſly, diſcover a multitude of diſtinct Pores, that by ſome Experiments one may be induced to gueſs, reach all along, and make the Cane like a Cylindrical Bundle of Minute Pipes; or rather a multitude of ſmall cavities, that perforate from end to end the *Parenchyma*, or Subſtance analogous to it, that gives them ſtability. And for the preſent this ſort of Veſſels ſeem to me, the more likely to be thoſe that convey the Blood to the extream Parts of the Hair, becauſe even in Horſe hairs, which yet are nouriſhed and grow, I am not yet ſure, that I have diſcovered with my Microſcopes any cavity, and therefore ſuſpect there may be divers imperceptible ones, for the Hair is nouriſhed and grows, which it is not like t ſhould do if the Body were ſolid; and if there were but a ſingle cavity in it, as in the lower part of a Quill, 'tis like the Microſcope I uſed would have diſcovered it, ſince with one much inferiour I could eaſily ſee, that ſeveral little ſhort Hairs, that grow upon the Animal that yields Musk, had each of them a cavity in it like that of the lower part of a Quill.

To the things that have already been ſaid about the Poroſity of Bones, I ſhall now add an obſervation of a very learned Phyſician, that is very remarkable to our preſent purpoſe, becauſe it argues, that even Bodies not ſaline, nor actually moiſt, may from without get into the Pores and Cavities of Humane Bones. Divers Phyſicians have complain'd of the miſchiefs done to the Bones by Mercury, employ'd to ſalivate in Venereal Diſeaſes. Whereof I remember I have read a very notable Inſtance, in a learned Book (which I have not now by me) of an eminent Roman Profeſſor of Phyſick, who had the opportunity of making ſeveral curious obſervations in the famous Hoſpital of the *Incurabili* at *Rome*; and is therefore the more to be credited; where he relates, that in the Cavity of at leaſt one Pocky-mans Bones, there was found real Quick-Silver that had penetrated thither. And this brings into my mind a memorable obſervation of an ancient and experienced Phyſician, who being famous for the cure of Venereal Diſeaſes, was asked by me, what Inſtances he had found of the Penetration of Quick-Silver, either outwardly or inwardly adminiſtred, into the Bones of men? To this he anſwered, that he could not ſay he had himſelf taken notice of any Quick-Silver, in the Cavities of greater Bones, but that ſome other Practitioners had told him, that they had met with ſuch Inſtances, as I enquired after. But for himſelf, he only remembred that a Patient, who had been terribly fluxed with mercurial Inunctions, coming afterwards to have one of the Grinders of his lower Jaw pulled out, becauſe of the raging pain it had long put him to; my Relater had the curioſity to view narrowly this great Tooth, and found, to his wonder, a little drop of true Mercury in that ſlender Cavity of the Root, that admits the ſmall Veſſels which convey nouriſhment and ſenſe to the Tooth, in more than one of whoſe three Roots he affirmed to me that he found true, though but exceeding little, Quick-Silver. But a full Teſtimony to my preſent purpoſe is afforded me by the experienced Phyſician *Euſtachius Rudius*, who relates, that he ſaw himſelf, and that others alſo obſerved, ſome Bodies diſſected, of thoſe that had been anointed for the Venereal Pox, in the Cavities of whoſe Bones no ſmall quantity of Quick Silver was got together, (which yet (to add that upon the by) he ſays, did not hinder ſome of them from living many years, ſurviving thoſe Inunctions.)

Euſtach. Rudius (apud Sennertum) lib. 5. de morbis acutis cap. 15.

CHAP. VIII.

I Am not ignorant that, among the Particulars laid together in the foregoing Eſſay, there are ſome that are not abſolutely neceſſary, to prove the Porouſneſs of the Bodies of Animals. But I thought it not impertinent to mention them, becauſe I hoped that they, in conjunction with the reſt, may be of ſome uſe to Naturaliſts, in giving an account of ſeveral things that paſs in a Humane Body, whether ſound or ſick, eſpecially if it be of a Topical diſeaſe, and may remove, or much leſſen that great Prejudice, that makes many (and ſome of them otherwiſe learned) Phyſicians deſpiſe the uſe of all *Amulets*, *Pericarpia*, and other external Medicines in Diſtempers of the Inward parts, upon a confident, but not well grounded ſuppoſition, that theſe Remedies immediately touching but the outſide of the Skin, cannot exerciſe any conſiderable operations upon the internal parts of the Body.

But though I have thus acknowledged ſome Paſſages of the foregoing Eſſay to be ſupernumerary, yet I muſt not diſmiſs it without intimating that I might from one Topick more have fetched a probable, though not a demonſtrative argument, in favour of the Porouſneſs of Animals. For this may be very probably argued from hence, that even Inanimate, Solid and Ponderous Bodies, that in all likelyhood muſt be of a far cloſer Texture than the living Bodies of Animals (whoſe various Functions require a greater number and diverſity of Pores in their differing Organs) are not devoid of Pores, and have ſome of them very numerous ones, as will be ſufficiently made out in the following Eſſay, to which I ſhall therefore haſten.

N. B. The following Paper is that which is refer'd to in the 35th Page of this Eſſay.

Pharmacopœiæ Regiæ claſſis xiii. *pa.* 614. 615.

Hujus rei veritatem comprobat Doctiſſimus ac celeberrimus Medicus & Philoſophus D. Johannes Chryſoſtomus *Irmbler, Statuum Moraviæ Marchionatûs Protomedicus, his verbis ad me ſcribens: Et revera paravi ego, Anno M.* DCLV, *quo tempore inter Infectos verſabar quotidie, Trochiſcos Bufonios, eóſque ut cætera Helmontii, indefeſſi veritatis indagandæ, & ex puteo Opinionum veterum noſtram credulitatem excæcantium eruendæ, nati Philoſophi, experimenta ſuas laudes ſuſtinere comperi: Inter, viginti autem Bufones vix unum quidem, jucundo ſane ſpectaculo, vidi vermiculos, per nares & oculos egreſſuros, manu repellere quamdiu poterat, donec elanguerit Bufo: ſed Trochiſcos ex vermiculis unà cum pulvere emortui bufonis, & materiâ per anum (non-*

dum vidi per vomitum;) ſcilicet alis, pedibus, capitibus, ventribus Scarabæorum viridibus, auratiſve & nigris, quos bufo cum terra in eſcam venatur, ejectâ, cerea patinâ exceptis, cum Tragacantho roſato formatos, pluribus perſonis ſuper anthraces apponi feci, atq; nullum eorum mortuum eſſe dicere poſſum, ſed & meorum domeſticorum, ut & aliorum, quibus dedi, amicorum nullus, quod ſcio, infectus eſt. Sic comperi non tantùm hiſce Trochiſcis enervari virus peſtilens in Carbunculo jam admiſſum, ut dein vulgaribus chirurgicis remediis ulcus facili negotio fuerit curatum, ſed etiam ad ſiniſtram mammam ligatos, mihi meiſque accurſui & occurſui infectorum expoſitis, animoſitatem quandam indicibilem conferre, atque ita miaſmata & effluvia peſtilentialia abarcere. Hucusque Excel. Medicus Moraviæ.

An Eſſay of the POROUSNESS OF SOLID BODIES.

CHAP. I

AS 'twill with far leſs difficulty be allowed, that Animals and Vegetables, and ſuch Bodies, as have belonged to either, abound with Pores, than that Inanimate, Solid, and even Ponderous Bodies are not deſtitute of them: So 'tis far leſs difficult to make out the former than the latter of theſe Propoſitions.

ſitions. And therefore, *Pyrophilus*, I hope you will not expect that I ſhould give you as many proofs of the one, as I have of the other; however I deſpair not, that thoſe I ſhall preſent you, will appear ſufficient for my purpoſe, though they be not numerous enough to make me careful to marſhal them in any exact order.

Of the reaſons that induce me to think that even Solid Bodies are not deſtitute of Pores, there are *ſome* that have a greater Affinity with thoſe arguments that the Schools are wont to call *à priori*, becauſe they require more unobvious Ratiocinations upon Phyſical Principles, and *others* which reſemble, and indeed are, ſuch proofs as are uſually named *à poſteriori*, being ſuggeſted by the *Phænomena* afforded us by experience, without the help of any difficult Ratiocinations.

Of the Firſt ſort of Reaſons I ſhall propoſe to you three; and begin with that, which may be drawn from the Origine and Formation of divers hard Bodies.

See the Tract of the Origine and Vertues of Gems, and the Notes about the Mechanical production of Hardneſs.

Bodies. For I have elſewhere endeavour and I hope not unſucceſsfully, to ſhew, both that divers ſtones, and even Gems themſelves, and that ſeveral Metalline and other Mineral Bodies, were once either viſible Liquors or at leaſt very ſoft ſubſtances. And I have elſewhere proved, that both theſe kinds of Bodies do conſiſt of,(which is the caſe of Liquors) or abound in (which is the caſe of ſoft and moiſt Bodies) minute particles of determinate Sizes and Shapes; from whence I think one may very probably conclude, that ſuch Gems and other Mineral Bodies, notwithſtanding any hardneſs they afterwards come to acquire, are not deſtitute of Pores, ſince 'tis no way likely, that Corpuſcles of various and very irregular Figures, ſuch as thoſe of moſt Liquors of the terreſtrial Globe are wont to be, can be ſo brought together, eſpecially by chance, cold, or any other ſuch agents, as not to intercept little Intervals or Pores between them.

CHAP. II.

ANother thing which makes me think the Poroſity of the moſt part even of Solid Bodies to be great, is the conſideration of the great diſparity, that may be found in the ſpecifick Gravities of ſuch Bodies, as the Eye does not perceive to be Porous. For, *though* Water be a Body of that kind, and though its parts be ſo cloſe packt together, that the attempts of Ingenious men, to make a manifeſt compreſſion of that Liquor by outward violence, have not hitherto proved ſucceſsful, *yet* we find, that ſtones, Clays, metals, and even ſome Woods and a multitude of other kinds of Solids, will readily ſink in Water, and by conſequence are ſpecifically heavyer than it; which greater gravity ſeems not any way explicable, without ſuppoſing, or at leaſt ſo well as by ſuppoſing, that the Corpuſcles whereof ſuch ſinking Bodies conſiſt, do either lye cloſer together, or are ſeparately more ſolid, than thoſe of Water; which Liquor muſt conſequently be Porous, though neither the Eye, nor the great force that has been ſeveral ways employed to compreſs it, can diſcover any Pores in it. Upon the ſame ground I further conclude, that ſolid Stones themſelves, as Marble, Flints, &c. Are not free from Poroſity. For whereas, as far as ſeveral Tryals purpoſely made can inform me, I have found, that ſuch of theſe as have nothing metalline in them do ſeldom or never reach to treble the weight of an equal bulk of Water, they will, upon the former grounds, appear to be conſiderably Porous; ſince the lighteſt metals, which are Tin and Iron, are above twice heavier *in ſpecie*, that is, the bulks being equal, than Marble, Flints, Chryſtal, &c. And by the ſame reaſon I alſo infer the great Poroſity, even of the Solid Body of Iron, which is as well heavier, as very much harder, than Tinn. For though

Copper be a good deal more ponderous than Iron, or Steel, yet I have divers times found fine Gold, to be more than twice as heavy *in ſpecie* as Copper, ſince, whereas this Metal, whether it be *European*, or brought from *Japan* (for of that alſo I made Tryal) is about nine times as heavy as ſo much Water; I found refined Gold to be about nineteen times as heavy as Water equal to it in bulk. By which it ſeems highly probable, that ſo ſolid and heavy a Body, as Iron or Steel it ſelf, may be ſo porous, that Metalline matter equal to it in weight may naturally be contained in much leſs than half the Dimenſions that Metal poſſeſſes. And that Gold it ſelf, which is the moſt comPact and ſolid Body we know of, is not deſtitute of Pores, may appear by the Diſſolution of it in Quick-Silver, of which I ſhall ſpeak a little below. And if any ſhould pretend, that hardneſs may be a greater argument of the Compactneſs of a Body, and its immunity from Pores, than its ſpecifick weight can be; I ſhall add, that though I have found that *Emery*, which is the Body employed to cut ſteel and Load-ſtones and Cryſtal, and the moſt of Gems, being indeed much harder than Marble or Flints, be far heavier than thrice its bulk of Water; *yet* that ponderouſneſs proceeds, as I elſe where intimate, from the mixture of a metalline Subſtance, which I have ſeparatted from it. And Diamonds, though much harder Bodies than *Emery*, and indeed the hardeſt we know of in nature, are ſo far from being, as ſome of late have written, the moſt ponderous of Bodies, that having examined them hydroſtatically, by a way elſewhere mentioned, I found them not much heavier than either Cryſtal, or fine Glaſs, and not half ſo heavy as the lighteſt Metals.

CHAP. III.

THe next thing, from which the Porouſneſs of Solid Bodies, and even thoſe that belong to the Mineral Kingdom (as the Chymiſts ſpeak) may be deduced, is the ſame with the firſt of thoſe from which we formerly argued the Poroſity of Subſtances belonging to the Animal Kingdom, namely, the very frame & conſtitution of ſuch Bodies. For the ſolideſt Bodies themſelves, reſulting from the Convention or Coalition of a great number of Particles of ſeveral bigneſſes and ſhapes, we cannot reaſonably ſuppoſe, (eſpecially in thoſe concretes wherein they are not ranged by a ſeminal Principle) that they ſhould be contexed ſo, as to touch one another exactly every where and therefore they muſt of neceſſity leave ſome little Intervals and Pores between them.

This reaſon will, I hope, appear clear enough of it ſelf, to him that ſhall attentively conſider it, eſpecially if he know, that it has been Geometrically demonſtrated, that there are but very few figures that will, (as they ſpeak) *implere ſpatium*, that is, which being adjuſted to one another will ſo exactly touch, that there is not the leaſt unfilled ſpace within the circumference or circuit, if the figures be plain, or within the ambient *Superficies*, if they be ſolid; ſo that, conſidering the vaſt variety of other Figures, which made *Epicurus* and other *Atomiſts* pronounce it *incomprehenſible*, 'tis very obvious to conceive, that Corpuſcles of ſuch differing ſhapes being put together, will leave multitudes of little Pores intercepted, between thoſe parts that do not every where touch one another. And even the Mathematical Figures lately ſpoken of, may be ſaid to fill ſpace rather in a *Geometrical* than a *Phyſical* ſenſe. For, if ſuch Portions of matter as are required to conſtitute, for inſtance, a Cube, were actually put together, they would not exactly fill the ſpace comprehended within the ambient ſurface of the Body they compoſe, becauſe the component Bodies, being Phyſical, conſiſt of Corpuſcles of their own particular ſhapes, which we never find Mathematically exquiſite. As if, for example, the Cube were of Marble; no Art could poliſh the ſides of a component Body ſo, as that they ſhould be perfectly ſmoothed ſince (as, if I miſtake not, the learned *Gaſſendus* well obſerves) Emery, Pumice-ſtone, and even Puttee, or other Powders that are employed to poliſh them, do themſelves conſiſt of little hard angular Corpuſcles, that leave ſmall ſcratches, like ſo many little furrows, on their ſurfaces, which muſt needs hinder the perfect contact of the whole ſurfaces of two contiguous Bodies, and conſequently leave here and there Intervals or Pores, between thoſe ſurfaces; to which I ſhall add that Marble it ſelf as 'tis Marble, abounds with internal Pores, as will ere long appear by

Experience, and as may be rationally conjectured from the Specifick Levity of it, in compariſon of Gold and Lead.

CHAP. IV.

HAving diſpatched the Arguments *à priori*, that may be imployed to ſhew the Porouſneſs of Solid Bodies, 'twill be now ſeaſonable to propoſe ſome Experiments and obſervations, that may (as 'twere) *à poſteriori* either evince or confirm the ſame Doctrine.

Of theſe Inſtances ſome relate to Solid Bodies that are of leſs ſpecifick gravity ſome to Foſſiles preſumed to be devoid of Metalline parts, ſome to Minerals that are thought to participate of a Metalline nature, ſome to Metals themſelves, and ſome to Glaſs.

To begin with the firſt ſort of theſe Inſtances; That Wood is Porous, there are many things that argue; ſome of which are elſewhere mentioned. But few would ſuſpect, that Quick-Silver which is ſo unapt to enter the Pores of Bodies much leſs compact, ſhould permeate peices of Wood of a conſiderable thickneſs; and yet, that we have made it do by the following Experiment. We took a wooden Trunk, ſuch as is employed to ſhoot pellets at Birds, with ſtrength enough to kill them, and having cloſely ſtopt one end of it, we poured in Quick Silver at the other, till it reached to a good height in the cylindrical Cavity of the Inſtrument, and then the lower parts of the Metalline Liquor, being aſſiſted by the weight of the Incumbent ones, (not to mention that of the Air) to preſs into the Pores of the Wood, they iſſued out at them on all ſides, in great numbers of minute drops, much after the manner of Quick-Silver ſtrained through Leather, out of amalgams; which was a *Phænomenon* not unpleaſant to behold. But till I have opportunity to repeat this Experiment with differing circumſtances, I ſhall not think it fit to lay much ſtreſs upon it, for want of knowing, what intereſt the great weight of the Quick Silver may have had in the event.

And this caution may perchance be applicable to the following Experiment, namely, that having, by the help of my Pneumatical Engine, withdrawn the Air from one ſide of a round peice of board, the Air on the oppoſite ſide, not having its preſſure any longer reſiſted by that which it uſed to meet with from the withdrawn Air, preſſed ſo ſtrongly againſt the ſurface of the Wood expoſed to it, as to make it ſelf way through the Pores of it, and get copiouſly enough into the Cavity whence the other Air had been pumpt out; (the weight of the incumbent Atmoſphere doing on this occaſion, what the weight of the Quick-Silver did on that laſt recited:). Which was a ſurprizing ſpectacle to the by-ſtanders becauſe the board that was thus permeated, was of ſtrong Wood, and of conſiderable thickneſs.

I ſhould here ſubjoin ſeveral other Arguments of the Porouſneſs of Wood, if I could diſplay them without more words, than I am willing to allow them;

and I preſume it may here ſuffice, if I let you ſee by ſome ſurprizing Effects that when Wood is reduced to that thinneſs, that its cloſeneſs or Poroſity may conveniently be examined, it will eaſily enough give paſſage, even unto viſible, odorable, and tinging Corpuſcles though they invade it not in the form of a Liquor, but of dry Exhalations, ſo they be not incommenſurate to its Pores. This I ſuppoſe, you will not ſcruple to infer from the following Tryals, as they were long ſince ſet down in one of my Note-Books.

1. The Fumes of our ſmoaking Liquor [deſcribed in the foregoing Eſſay] tinged a Copper half penny, through a broad thin ſhaving of Dale, that did not, when held againſt the window, diſcover any perforation; tinged it, I ſay, very deeply in about a quarter of a minute and ſomewhat leſs.

2. The ſame Fumes tinged manifeſtly, but not ſo notably, the ſame half penny firſt cleanſed through two ſuch ſhavings of Dale, laid one upon

another in ſomwhat leſs than one minute.

3. And in about one minute the ſame Fumes tinged the cleanſed half penny, through three ſuch ſhavings of Dale very viſibly, but not ſo conſpicuouſly, as through the two forementioned. Theſe Tryals were made without the help of heat to promote the operation of the Fumes.

CHAP. V.

From the conſideration of Woods let us now proceed to give ſome Inſtances of the Porouſneſs of Bodies made of cloſe and compacted, and perhaps well baked Clays or other Earths.

That Earthen Veſſels, thô ſtrong and well bak'd, are many of them porous enough may be argued not only from what has been lately recited, but from hence, that ſome of them will ſuffer themſelves to be ſoakt through by Oyl. Others by ſolutions of Nitre, and ſome other Salts. And there are very few of them, without excepting *Haſſian* Crucibles themſelves, that will long keep Salt of Tartar, and ſuch like fixt Alcalies, in fuſion without being penetrated by them. I have heard Diſtillers complain, that when they have diſtilled corroſive materials, as Vitriol and Salt-Petre, with ſtrong fires, in thoſe Earthen Veſſels that are commonly made uſe of in *London* (eſpecially by refiners) inſtead of Retorts though their necks be ſtrait and long (upon which account they are called long-necks) a conſiderable quantity of the fineſt Spirits make their eſcape quite thorow the Veſſel; ſo that in the Retort and Receiver many ounces are found wanting, of the firſt weight of the matter to be diſtilled. And this ſometimes, when the Vitriol has been previouſly calcin'd, and a reaſonable allowance has been made, for what may have eſcaped thorow the Lute, that joined together the long Neck and Receiver.

And *though* I have obſerved of our Bottles, made of the ſame Earth with Juggs, that they are hard enough to ſtrike Fire with a good Steel, *yet* a good Experimenter upon ſuch Veſſels of whom I made enquiry, has aſſured me that theſe, as compact as they are, may, even without external heat, have their Pores pervaded by the finer parts of Spirituous Liquors.

To this purpoſe I remember that meeting once with a *Virtuoſo*, that was curious about the ways of making Sider as brisk and ſpirituous a Liquor as he could; I enquired of him, whether he was able to keep in the ſubtil Spirit of this Skilfully fermented Liquor, in thoſe earthen Bottles, that, by reaſon of the ſolidity they acquire by the vehement coction of the Fire, are commonly called *ſtone Bottles*; to which he replyed. that he often found to his trouble, that the Liquor would permeate the compact Subſtance of the Bottles: And when I objected that the Spirits might either eſcape out at the Cork, which I have made ſeveral Spirits of divers kinds that would readily permeate; he replyed, that what he had ſaid appeared by the outſide of the Bottles: To which when I further objected, that the ſight of dew on the ſurface of the Bottles, would not convince me, without taſting whether it were vinous, becauſe I had divers times obſerved, that brisk Liquors would produce a dew, on the outſide of the Veſſels that contained them, not by any tranſudation (for I have made Tryal of it in Glaſſes) but by condenſing the aqueous vapors, diſperſed through the neighbouring part of the Ambient Air: He replyed that, beſides what his taſt had informed him of the quality of this dew, he found that the included Liquor, though exactly ſtopt, waſted in not very many Months ſo conſiderably, as ſometimes to loſe a ſixth, or even a fifth part; & this eſcape or percolation of the Liquor through the Subſtance of the Veſſels, he affirmed himſelf to have obſerved, not only in one or two Bottles, but in very many and the like obſervation for the main was confirmed to me, upon his own experience, by an eminent Phyſician, who, being a great Lover of brisk Sider, uſed to bottle it up early and carefully.

Though good *Haſſian* Crucibles be very cloſely compacted, as well as throughly baked Bodies, and upon that account are able to keep Silver and divers other Metals long in fuſion, without letting them at all run out; *yet* having diſſolved Silver in *Aqua fortis*, I obſerved that, *though* the Salts were by this operation ſo chang'd that this horn-like Silver did diſſolve neither in the *Aqua fortis*, nor in the *Aqua Regia* that I put it into; *yet* when I kept it a while in fuſion, (which 'tis eaſily brought to be) among quick Coals, it would without cracking or perforating the Crucible, ſoak into it, and permeate the Pores of it, in I know not how many places, as I convinced ſome curious perſons, by ſhewing them on the outſide of the Veſſel, a multitude of minute globules of pure Silver, like ſo many little drops, that were got thither, as it were, by tranſudation.

CHAP. VI.

FRom baked Earths, that are deſigned in point of hardneſs to emulate ſtones, we will proceed to give ſome inſtances of the Porouſneſs of Natural Stones themſelves.

There goes a tradition, that in ſome part of the *Weſt-Indies* they have a Stone, of which they make large Veſſels, wherein they put Water to percolate, as it were, through a ſtrainer. Of theſe Veſſels, I had one ſent me for a preſent, whereof being hereafter to give ſome account in a more opportune place, I ſhall now only take notice that I found that Water would (thô ſlowly) ſoak through the Veſſel, thô it were conſiderably thick.

If, as many of the Ancients, and

moſt of the modern Corpuſcular Philoſophers have conceived, the Tranſparency and Opacity of Bodies proceeds from a Rectitude or Crookedneſs of Pores, which makes them fit or unfit to tranſmit the Light, that tends to pervade them in Phyſically ſtraight Lines: If this *Hypotheſis*, I ſay, be allowed, we may draw a very probable argument, that Stones may be Porous, from the *Phænomena* of that odd Gem, that is beſt known by the name of *Oculus Mundi*. For this ſmall ſtone (at leaſt that which I made my Obſervations of) when 'tis dry, and is kept in the Air, is opacous, almoſt like a poliſhed piece of white Amber, and ſo it continues, as long as 'tis kept dry. But if you put it into fair water, it will in no long time, become by degrees quite Tranſparent, and that which I made Tryal of looked then not unlike a piece of clear yellow Amber which by degrees does in the free Air loſe its Tranſparency and turn to be opacous as before. Now according to the above mentioned

Corpuſcular *Hypotheſis*, the Pellucidneſs which the Stone acquires in Water, may be accounted for, by ſaying, that the Liquor getting in at the crooked Pores of the Stone, does for the time rectify them, and make them pervious to the ſtraight Beams of Light; as we ſee that White Paper, being wetted with Water, or, which does far better, being made to imbibe Oyl, has its Pores ſo changed and rectified, that the Water much leſſens its Opacity, and makes it almoſt Semidiaphanous and the Oyl, if it be fine and well ſoaked up, makes it Tranſparent. But upon the receſs or evaporation of the imbibed Particles of Water, the Pores of the little Stone becoming crooked again reflect the Rays of light they ſhould tranſmit. Which explication will be the better allowed of, if my memory do not miſinform me, when it tells me, that a learned Member of the Royal Society found the *Oculus Mundi* to weigh more in a nice ballance, when it was taken out of the Water and well wiped, than before it was put in. This Stone, which very few of the writers about Gems take notice of, is ſo rare and difficult to be got, that I had not opportunity to make upon it all the Tryals I deſired; and therefore, though the Subject be curious, I may, I hope, be excuſed, if I haſten from it to another.

There is ſo much difference in many Qualities betwixt Stones and Metals, that 'tis very probable, that when the Corpuſcles of both come to be brought together into one Maſs, they will not touch one another ſo cloſe, as not to leave ſtore of little Intervals or Pores between them. And upon this ground I have been apt to think that divers very hard Stones, Diaphanous and Opacous, are not devoid of Poroſity. For I have elſewhere delivered a way by which I have obtained good ſtore of Metalline parts, both from American *Granats*, and from *Emery*; though this laſt be ſo exceeding hard a Stone, that 'tis uſually imployed by artificers to work upon

Iron and Steel, and to cut not only *Rock Cryſtal*, but divers Gems that are harder than either that or Steel.

Upon the ſame ground one may probably infer the Poroſity of many Artificial Gems made by Fuſion; for to give theſe the colour of Sapphirs, Topazes, Amethyſts, *&c.* we are wont to add to the vitrifiable matter, either ſome prepared metal, as calcined Copper, *calx* of Gold, *&c.* or elſe ſome Mineral as *Zaffora* and *Manganeze* (as the Glaſs-men call *Magneſia*) that abounds in Metalline parts. Nay I remember, I have ſometimes given the colour to the vitrified ſubſtance, by imploying natural Gems, as Granats; though to ſhew that the coloration which the maſs received from theſe, proceeded from the Metalline Corpuſcles, that lay hid in the tinging matter, the Colour produced was not that which was conſpicuous in the Gem it ſelf, but one very different from it, and ſuch as the metal, which upon other accounts I ſuppoſed the Gem to partake of, ought, according to the

Grounds I proceeded upon, to produce in the vitrifiable matter. And this very Experiment makes it alſo highly probable, that even natural tranſparent Gems, (divers of which are much harder than Marble, Iron & even Steel) are themſelves Porous; ſince, notwithſtanding their Tranſparency and ſeeming Homogeneity. They are made up of Ingredients o ſuch differing natures as are Stony and Metalline Corpuſcles.

From the ſame Ground we may likewiſe deduce the Poroſity of Marcaſites; many of which I have obſerved to be, not only hard enough, plentifully to ſtrike fire by colliſion with Steel, but more ponderous than even divers Oars, that were rich enough in Metal, to be wrought with good profit. And yet theſe hard and heavy (Mineral) Stones are very far from being homogeneous; ſince I have met with few Inanimate Bodies, produced by Nature her ſelf, ſo compounded as ſeveral Marcaſites that I have ſeen. For theſe are wont to contain more or leſs Copper, and Iron too: and they abound in Combuſtible Sulphur, a Corroſive Salt, and a certain Fixt Subſtance, which I found to differ from true Earth, but of whoſe Nature the Tryals I have hitherto made on it, have but little ſatisfied me.

I might here deduce the Poroſity of the Load-ſtone, as hard and ſolid a Body as it is, partly from the *Effluvia* it emits and admits, and partly from the Heterogeneity I have by Chymical Tryals found to be in it. But theſe things belong more properly to a Paper about Magnetical Bodies, for which I the more willingly reſerve them, becauſe other Experiments will keep them from being needful to be here inſiſted on.

The Poroſity of Marble, and divers other Stones of like Contexture, may with probability be deduc'd from this, that they are liable to be diſſolved by divers of the corroſive *Menſtruums* of the Chymiſts, ſuch as *Aqua fortis* ſp. of Salt, *&c.* And ſome of them even by Vegetable Liquors, of Natures own preparing, as the juice of Limons, and that of Barberries. But a more noble and ſatisfactory inſtance may be afforded, by the invention of ſtaining or colouring white Marble, without imploying any fretting Liquor, or ſpoiling the Texture of it. This way being caſually lighted on by an ingenious Stone-cutter in *Oxford*, who gained by it both credit and money, he long ſince thought fit to acquaint me with it, upon condition of ſecreſy (which I have to this day inviolably kept) and of my aſſiſting him to improve his Invention by making it practicable with other Colours than Red. Theſe circumſtances I mention, to ſignify that I write not by gueſs, of this matter, having both ſeen the Experiment tried, and made it my ſelf. But though I found it far leſs improvable to other uſes, then one would expect, yet, as to our preſent purpoſe, it is very appoſite. For by this way an excellent red Colour, may be made to ſoak into a piece of White Marble, almoſt as Oyl will do into Leather, without impairing, that I obſerved, the ſolidity of the ſtone, which, after being dyed, will be capable of a fine gloſs as before. Some other Colours (yet but few fair ones) would by this way be brought to ſoak into Marble, on which one may with them ſo define, and limit the Colorations, that I remember the Artificer, when I brought him to kiſs the Kings hand, preſented His Majeſty with an *Andromeda*, whoſe Colours were ſo vivid, that this skilful Judge of curious things, was pleaſed to honour it with a place among his Rarities. And, to ſatisfy his Majeſty that the fine Red was not, as ſome ſuſpected, a mere varniſh, I purpoſely broke a plate of Marble, in whoſe fragments he ſaw, that the Pigment had ſunk to a conſiderable depth, into the very Subſtance of the Stone. And I doubt not but it might have been made eaſily enough to ſink much deeper, if it had been thought neceſſary. A fine Plate of ſuch White Marble, with the penetrating Pictures of Coloured Flowers drawn upon it. I yet keep by me to ſatisfy the curious. And ſome Utenſils, as Hafts of Knives, Salt-Sellers, &c. I have known to have laſted ſeveral years.

There is an Experiment that ſeems much ſtronger for the Porouſneſs of Solid Bodies, than that it ſelf (which was lately recited) of ſtaining Marble. For in *Italy* ſome Goldſmiths have a way of imbuing Fragments of Rock-Cryſtal, which is a Body much harder than Marble, with divers Colours; which do ſometimes ſo imbelliſh them, that having ground off thoſe parts that would not receive the ſame Tincture, they ſet ſome of them in Gold Rings, and ſell them with profit. When I was inform'd of this, I thought of a Compoſition, that I hop'd might perform the ſame thing, and perhaps better than that which was employ'd by them, who either knew not, or for ought I could perceive, us'd not, ſome Minerals that I thought fit for the purpoſe. Upon this Preſumption we carefully cemented ſome clear Fragments of Native Cryſtal with a

Compoſition of ſome Volatile Minerals, together with a Salt or two, and having ſuffered the Crucibles to cool leiſurely, we had divers of the Fragments ſtain'd here and there, ſome with one Colour and ſome with another, as differing Fumes happen'd to invade them. And of theſe Colours ſome were dark or dull, and ſome vivid enough. But having conſider'd the ſtain'd pieces, and the progreſs of the Operation, more attentively, I began to doubt, whether theſe Adventitious Colours were really produced by the bare penetrating of the Mineral Fumes into the Pores of the Cryſtal it ſelf. For I thought it poſſible, and not very unprobable, that the great Heat of the Fire, and the Ambient Mixture, might cleave or flaw in many places ſome of the Cryſtalline Fragments; and that the finer parts of the Minerals being vehemently agitated, might inſinuate themſelves into theſe thin Flaws, which upon the ſlow refrigeration of the Stones, ſhutting themſelves cloſe again, might lock up the tinging Particles, without appearing diſcontinued, eſpecially to the Eyes of Perſons that were not made uſe of with a more than ordinary attention, excited by diſtruſt. This ſuſpicion was not removed by the apparent entireneſs of each little piece of Cryſtal. For having taken more than once a Lump of that ſtone, and ſlowly brought it to be red hot in the Fire, I found that if I warily quenched it in Water, though it would thereby acquire a multitude of little cracks or Flaws, which deſtroyed its former tranſparency, and made it look whitiſh, yet it continued ſtill an entire Body, notwithſtanding the diſadvantageous haſte, wherewith the operation had been performed. And having after this ſuſpicion, inquired of an ingenious Lapidary, that belonged to a great Prince whether in poliſhing of Gems upon the Wheel, he had taken notice that the Heat would flaw them, he anſwered me, that now and then he had obſerved that ſome Stones, eſpecially, if I miſremember not, Rubies, when they were very much heated by the ſwift motion of the Engine he employed to poliſh them, did cleave as it ſeemed to him, and gape, ſo as at firſt to make him fear the Stones were ſpoiled; and yet afterwards they cloſed ſo perfectly, that no Flaw at all could be perceived in them. I have mentioned the foregoing Experiment of tinging Cryſtal, to comply with the dictates of Philoſophical candor, which forbids me to lay much ſtreſs upon a Proof, whoſe validity I my ſelf diſtruſt. But perhaps my ſuſpicion may by further Tryal, which I have not now conveniency to make, appear not to have been well grounded, and in that caſe the tinging of Cryſtal, as well inwardly as outwardly, by Fumes will be a noble Argument for the Poroſity of Solid Bodies, Rock-Cryſtal being harder, and probably cloſer, not only than Marble, but even than Glaſs.

CHAP. VII.

THat Metals, though the heavieſt of Bodies, are not deſtitute of Pores, may be with probability proved in a general way by this; That they are all diſſoluble in their appropriate *Menſtruums*, as Gold in *Aqua Regia*, and all the reſt in *Aqua Fortis*, except Tin, which yet it ſelf will be corroded by that *Menſtruum*, though not well kept up in a fluid form, as it may be by another *Menſtruum*, which I elſewhere teach; and ſometimes the ſame Metal may be diſſolved by very differing *Menſtruums*, as Lead by *Aqua fortis*, and Spirit of Vinegar; and Copper by *Aqua fortis*, *Aqua Regia*, Spirit of Vinegar, Spirit of Salt, and ſome other Solvents, that upon Trial I have found ſufficient for that purpoſe.

But 'twill, I preſume, be thought more conſiderable to my preſent argument, if it be ſhewn, that Bodies that appear Groſs, and which in their Natural ſtate are not fluid, and are confeſſed to be of a compounded nature, will penetrate Metals quite through, even without melting them.

This we have divers times effected by a Cementation of Copper Plates, With common 🜍 (much a kin to a way preſcribed by ſome Alchymiſts to make *Vitriolum Veneris*) which we warily performed much after this manner. We took good Copper laminated to the thickneſs of a Shilling or thereabouts, and having cut it into ſmall pieces, that they might the more eaſily be put into a Crucible or Cementing Pot, we ſtrewed at the bottom of the Veſſel ſome beaten 🜍, and then covered it pretty well with ſome of theſe Plates, which were laid on flat-wiſe. Upon theſe we ſtrewed another Bed of powdered Brimſtone, and cover'd that alſo with Plates, upon which we put more Sulphur, & ſo continu'd making one lair of Brimſtone, & another of Metal, till we had employed all our Plates, or filled the Crucible, being careful that the uppermoſt Bed, as well as the loweſt, ſhould be of Sulphur. This done, we luted on an earthen Cover to the Veſſel, to keep the 🜍 from taking Fire, and afterwards having placed the Pot amongſt Coals kindled at a good diſtance from it, that it might be heated by degrees, we kept it for ſome few hours (perhaps Two or Three) in ſuch a degree of Fire as was ſufficient to keep the Sulphur melted (which is eaſily enough done) without bringing the Metal to fuſion; the Pot being cold, we took off the cover, and found the Plates quite altered in Colour and Texture, ſome of them having a dark and dirty Colour, whilſt others looked of a fine Violet or Blew; they were generally ſo brittle, that 'twas very eaſy to break them with ones finger, and reduce them to Powder. And (now to add ſuch Circumſtances as a Chymiſt would not take notice of) many of the Plates, when they were broken, appeared to have been (by the contiguous Beds of Sulphur above and below) horizontally divided each of them into two which does more advantageouſly than that made with Brimſtone, diſcover the Poroſity of Copper. For there is a way by which, without the help of Salts, Sulphur or Arſenick, one may make a ſolid and heavy Body ſoak into the Pores of that Metal, and give it a durable Colour. I ſhall not mention the way, becauſe of the bad uſe that may be made of it. But having had the curioſity more than once to try it upon a new Copper Farthing, the event was, that one part of it, which I purpoſely forbore to tinge, remained common Copper ſtill, but the other part acquired a yellow, that differed very little, if at all, from a Golden Colour, the former ſtamp that was impreſſed upon the coin continuing viſible. And to convince the ſcrupulous, that the Pigment did really ſink, and as it were ſoak into the Body of the Metal, and did not meerly colour the *Superficies*, I made them take notice, that the Farthing was not melted, and yet by filing off a wide gap from the Edge of the Coin, inwards, it plainly appeared, that the Yellow or Golden Colour had penetrated a pretty way beneath the ſurface of the Farthing; ſo that it looked there as if two thin Plates, the one Yellow, and the other Reddiſh, did, without any Interval between them, lye upon one another.

If Bodies be not to be pervaded, or deeply pierced into, by Corpuſcles, but only to have their more ſuperficial Pores, if I may ſo call them, penetrated thereby, 'tis poſſible that Bodies, which are either much harder, or much cloſer, than Marble, Alabaſter or the like Bodies, may have their Pores poſſeſſed even by odorous Corpuſcles; I ſay, *even by ſuch*, becauſe they are moſt of them groſs enough to be kept from exhaling, by Bodies much leſs compact then Earthen Bottles; and are far from being of the fineſt particles that Nature affords. But that ſuch odorous Corpuſcles may lodge themſelves in the exterior Pores of very cloſe Bodies, I have been inclined to think, *not only*, by the obſtinately which does more advantageouſly than that made with Brimſtone, diſcover the Poroſity of Copper. For there is a way by which, without the help of Salts, Sulphur or Arſenick, one may make a ſolid and heavy Body ſoak into the Pores of that Metal, and give it a durable Colour. I ſhall not mention the way, becauſe of the bad uſe that may be made of it. But having had the curioſity more than once to try it upon a new Copper Farthing, the event was, that one part of it, which I purpoſely forbore to tinge, remained common Copper ſtill, but the other part acquired a yellow, that differed very little, if at all, from a Golden Colour, the former ſtamp that was impreſſed upon the coin continuing viſible. And to convince the ſcrupulous, that the Pigment did really ſink, and as it were ſoak into the Body of the Metal, and did not meerly colour the *Superficies*, I made them take notice, that the Farthing was not melted, and yet by filing off a wide gap from the Edge of the Coin, inwards, it plainly appeared, that the Yellow or Golden Colour had penetrated a pretty way beneath the ſurface of the Farthing; ſo that it looked there as if two thin Plates, the one Yellow, and the other Reddiſh, did, without any Interval between them, lye upon one another.

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Since the writing of the former part of this Eſſay, having met with an inquiſitive Nobleman, who had lived in ſeveral parts of *Africk*, and was Governour of the beſt Town the *Europeans* have on that Continent, I diſcourſed with him, among other things, about the Skill that ſome aſcribe to the *African Moors*, of making excellent weapons, whereof I knew his excellency was very curious. Upon which occaſion he told me, that ſome of the Off-Spring of the *Granadine Moors* were indeed the beſt at making Arms that ever he met with; and that he had ſeen ſome weapons of their forging and tempering, that he preferred even to thoſe of *Damaſco*. And when I asked him whether any of them had the art of perfuming their Weapons, he anſwered me, that ſome of them did it admirably well; and inſtanced in a Blade which he kept for ſome years, & found it ſtill to retain the perfumed ſcent, which he ſuppoſed to be as it were incorporated with the Steel whereof the Blade was made. When I told him, I ſuſpected that the ſcabbard might have been well perfumed, and communicate its odour to the contained Blade, he allowed the objection to be plauſible, but replyed, that it was not concluding, ſince miſliking the Scabbard, as not handſom & faſhionable enough, he cauſed a new one to be made, wherein he afterwards kept it. And the ſame Lord further told me, that he had alſo a Fowling Piece, whoſe Barrel was perfumed. And when I objected that perhaps the odoriferous ſcent proceeded from the ſtock, and not from the Metal, he anſwered that the Gun not being, when it came into his poſſeſſion, skilfully and handſomely mounted, he cauſed the Barrel to be fitted with a new ſtock, notwithſtanding which, it continued to ſmell fragrantly. And when I further asked, whether he ever cauſed the Gun to be waſhed or ſcoured after it was grown foul by having been often ſhot in, he anſwered me, that he had, and, as far as I can remember, ſubjoyned, that after it was made clean it did (notwithſtanding the ill ſcent that the ſoot of the Powder had given it) retain a pleaſing ſmell, but fainter than before.

CHAP.

CHAP. VIII.

SInce the Subject of this Eſſay is the *Parouſneſs of Solid Bodies*, and ſince there is no Body that is generally reputed ſo cloſe and compact as Glaſs, it will be pertinent to this diſcourſe, and probably will be expected, that I ſhould here ſay ſomething about the Queſtion, whether Glaſs be, or be not, devoid of Pores.

But before I acquaint you with my Tryals, or my thoughts, about this Problem, I think it requiſite to clear the ſenſe, in which I mean to handle it, that I may not, as ſome others have done, for want of diſtinctly ſtating the Queſtion, ſpeak confuſedly and erroneouſly of it.

I ſhall then here obſerve, to prevent miſtakes, that the Poroſity of Glaſs may admit of two Acceptions. For it may be ſaid to be quite pervious to

Fluids, as a Boot is to Water, or only to be capable of having its ſuperficial parts further and further diſſolved or corroded thereby, as a Silver Cup is Porous in reference to *Aqua fortis*, which cannot ſweat through it, as Water does through a Boot, but eat its way through it, by diſſolving the Texture of the Veſſel.

Another thing requiſite to be premiſed, to prevent Ambiguity, is, that Glaſs it ſelf is not all of one ſort, as men unacquainted with Chymiſtry are wont to preſume, for Glaſs of Antimony, for inſtance, and that of Lead, both of them made *per ſe*, do manifeſtly differ, uſually in colour, and conſtantly in weight, and alſo in their operations upon Humane Bodies; and both theſe ſorts of Glaſs do in ſeveral points differ from *common Glaſs*, under which name, for brevities ſake, I comprehend both White or Cryſtalline Glaſs, as 'tis called in the Shops, and that courſer ſort, which they uſually call Green Glaſs; both which ſorts I here conſider under one Notion, because

cauſe both are made of fixt Alcalies, and other fit Ingredients, as Sand, Earth, Aſhes, Pebbles, or Flints, Colliquated by a ſtrong & laſting operation of the Fire: and 'tis of this common Glaſs, in the ſenſe now declared, that I ſhall conſider the Poroſity in the remaining part of this Eſſay. In which to proceed with ſome Method, I ſhall digeſt what I have to ſay into the enſuing Propoſitions, and the obſervations annext to them.

Prop 1. *'Tis very probable, that Glaſs may be pierced into to ſome diſtance, even by viſible and tangible Bodies.*

I know that this will ſeem a Paradox to many, and repugnant to common Experience, which ſhews that Glaſs Veſſels will contain very ſubtile and even highly corroſive Liquors, as the Spirit of Hartſhorn, of Urine, and that of Nitre; as alſo thoſe potent *Menſtruums*, as *Aqua fortis*, *Aqua Regis*, and Oil of Vitriol, which

I had alſo, if I miſremember not, another Vial, corroded by a diſtilled Liquor of Vitriol, that had in it more of the Phlegm than of the Oil; which you will ſomewhat the leſs wonder at, if you conſider, that ſome Corroſive *Menſtruums* will ſcarce work on ſome Bodys, if they be too well dephlegmed, or at leaſt will not corrode them ſo readily and powerfully, if they are very ſtrong, as when they are diluted with a convenient quantity of Water. And, as to Oil of Vitriol it ſelf, which is the *Menſtruum* I am ſpeaking of, when we employ it to make *Vitriolum Martis*, we are wont to weaken it with Water, that it may the better diſſolve that Metal. And perhaps you will ſuſpect, that Vitriol has ſome peculiar faculty of penetrating and fretting Glaſs, when to the Experiment newly recited I ſhall add that which follows, as I find it regiſtred among my Notes.

[A pound of *Dantzick* Vitriol and a pound of Sea Salt, after the former had been very lightly calcined, and the latter decrepitated, that they might not boil in, or crack the Veſſel; we cauſed to be diſtilled in a well coated Retort by degrees of Fire, giving at length a very ſtrong one, then taking off the Veſſel, we were not much ſurprized to find, that the heat had here and there melted it, and that the fluxed *Caput Mortuum* had corroded the Glaſs, fetching off as 'twere films from it, and thoſe parts which did not appear to the Eye thus manifeſtly waſted, ſeemed yet by their great brittleneſs, to have been penetrated, ſo that their Texture was ſpoiled by the ſaline and vitriolate Corpuſcles.]

Prop II. *Common Glaſs is not ordinarily permeable by Chymical Liquors, though ſtrong and ſubtile, nor by the directly viſible or odorable Expirations of Bodies tho abſolutely ſpeaking it be pervious to ſome Corporeal Subſtances.*

This Propoſition conſiſting of two parts, we ſhall allow each of them its diſtinct Proofs.

And as for the firſt part, 'tis mawhich not only are not obſerved to pierce into it, but are unable to make any ſenſible alteration, ſo much as on the ſuperficial parts, even in thoſe Vials wherein they have been long kept.

But, notwithſtanding all this, I preſume you will not condemn the lately propoſed Paradox, when you have conſidered what may be ſaid to juſtifie it. For, beſides that it may be made probable *à Priori*, by the Arguments whence we have formerly proved the Orouſneſs of Solid Bodies in general; there are two ſorts of Experiments, from whence one may argue, that Glaſs in particular is not devoid of Pores in the ſenſe wherein we are now ſpeaking of them.

And firſt, I remember, that, having kept for a good while in a vial, a quantity of a certain Spirit of Salt, that I had reſerved in a cool place; I found, when I came to uſe it, that the Glaſs was crackt, and moſt of the Liquor was run out; but, before this happened, it had ſo far corroded the inſide of the Glaſs, that in ſome places it was eaten almoſt as thin as a piece of Paper; and this part which yet continued Glaſs, was lin'd with a much thicker white ſubſtance, that ſtuck to the ſides of it, and look-ed and taſted like a kind of odd Salt; ſo that it invited me to conjecture, that it proceeded from the ſubſtance of the Glaſs, which you know conſiſts of an *Alcali* as well as of *Sand* corroded by the Saline Spirits of the *Menſtruum*, and coagulated with them into this odd kind of Concrete; and 'twas remarkable in our veſſel, that the upper part of the vial, to which the *Menſtruum* did not reach, was not corroded, nor alter'd, tho the operation of the Liquor reached as high as the Liquor it ſelf. And I remember, that when I related all this to ſome experienced Chymiſts, one of them that was a more heedful obſerver, aſſured me, the like had once or twice happened to him, as ſince that time it hath likewiſe done to me. I had

I had alſo, if I miſremember not, another Vial, corroded by a diſtilled Liquor of Vitriol, that had in it more of the Phlegm than of the Oil; which you will ſomewhat the leſs wonder at, if you conſider, that ſome Corroſive *Menſtruums* will ſcarce work on ſome Bodys, if they be too well dephlegmed, or at leaſt will not corrode them ſo readily and powerfully, if they are very ſtrong, as when they are diluted with a convenient quantity of Water. And, as to Oil of Vitriol it ſelf, which is the *Menſtruum* I am ſpeaking of, when we employ it to make *Vitriolum Martis*, we are wont to weaken it with Water, that it may the better diſſolve that Metal. And perhaps you will ſuſpect, that Vitriol has ſome peculiar faculty of penetrating and fretting Glaſs, when to the Experiment newly recited I ſhall add that which follows, as I find it regiſtred among my Notes.

[A pound of *Dantzick* Vitriol and a pound of Sea Salt, after the former had been very lightly calcined, and the latter decrepitated, that they might not boil in, or crack the Veſſel; we cauſed to be diſtilled in a well coated Retort by degrees of Fire, giving at length a very ſtrong one, then taking off the Veſſel, we were not much ſurprized to find, that the heat had here and there melted it, and that the fluxed *Caput Mortuum* had corroded the Glaſs, fetching off as 'twere films from it, and thoſe parts which did not appear to the Eye thus manifeſtly waſted, ſeemed yet by their great brittleneſs, to have been penetrated, ſo that their Texture was ſpoiled by the ſaline and vitriolate Corpuſcles.]

Prop II. *Common Glaſs is not ordinarily permeable by Chymical Liquors, though ſtrong and ſubtile, nor by the directly viſible or odorable Expirations of Bodies tho abſolutely ſpeaking it be pervious to ſome Corporeal Subſtances.*

This Propoſition conſiſting of two parts, we ſhall allow each of them its diſtinct Proofs.

And as for the firſt part, 'tis maniſeſtly agreeable to the Common Experience of Chymiſts; who daily find, that in well ſtopt Vials, or at leaſt in Hermetically ſeal'd Glaſſes, they can preſerve their ſubtileſt and moſt piercing *Menſtruums*, as Spirit of *Nitre*, *Aqua Fortis*, Spirit of Salt, Spirit of Vinegar, and Oil of Vitriol. And this they find to be true, not only as to Acid and Corroſive Liquors, like thoſe I have newly named, but alſo in thoſe Spirits that abound with Fugitive Salts, as the Spirit of Urine, of Blood, and of *Sal-Armoniack*; and in the moſt ſubtile & highly rectified Spirit of Wine; as alſo in the Ethereal Oil, or, as many call it, Spirit, of Turpentine: as likewiſe in the Liquors of Salt of Tartar, and other fixt Alcalies reſolved by *Deliquium*.

The Reſult of theſe Obſervations may be much confirmed by conſidering, how often it happens in the Deſtillation of more Wild and Fugitive Spirits, as of Nitre, Tartar, and Sugar; that, though they are much agitated, and perhaps ſubtilized, by Heat, yet, if the Lute, that joins the Receiver to the Retort be very firm & cloſe, the Receivers, though large, are often broken in pieces; which probably would not happen, if the Spirits could inſinuate & croud themſelves, through the pores of Glaſs.

But, whereas it may be pretended, that ſuch Veſſels are ſtrong and thick, I ſhall add, that I have had the Curioſity to cauſe very fine bubbles to be blown at the flame of a Lamp, purpoſly that they may be made extreamly thin, and of but a ſmall part of the thickneſs we meet with in the Veſſels made at the Glaſs houſe; and ſome of theſe I caus'd to be exactly ſtopt, and others to be Hermetically ſeal'd; but could not find, that either dry Salt of Tartar would relent in one, that was kept a good while under water, or that ſtrong Spirit of *Sal Armoniack*, which is one of the ſubtileſt Spirits that we know, would penetrate one of theſe thin films of Glaſs, which we kept a great while immerſed in it, though to diſcover whether it would at all penetrate the thinneſt Glaſſes, we employed ſome which were of that fine ſort that is called *Eſſence Vials.*

Theſe and ſome other Tryals have, I confeſs, made me very diffident of the Experiments, that have been delivered by ſome men of Note, and built upon by others, of the Permeableneſs of ordinary Glaſs Veſſels to Chymical Liquors, as, that Mercury and *Aqua fortis* being digeſted together in a Bolt-head may, by rubbing the outſide of the Glaſs, be made viſibly and palpably to tranſudate. Which Experiment (if my Memory do not much deceive me,) I purpoſely tryed with care, but without ſucceſs.

But after all this I muſt deſire, that it may be remembred, that in wording the Propoſition of the Imperviouſneſs of Glaſs, I intimated that I would have it underſtood of what *Ordinarily* happens. For in ſome *Extraordinary* caſes, which I take to be exceeding rare, I do not abſolutely deny, but that the General rule may admit of Exceptions. And, if it be lawful to conjecture, theſe exceptions are likelieſt to take place, when the peculiar Texture of this or that Glaſs, is more ſlight or lax than ordinary; or when the Bodies that are to pervade it, are vehemently agitated by heat; or when, beſides a great ſubtlety, and perhaps degree of Heat too, their particles chance to have a ſpecial congruity, to the relaxed Pores of that particular Glaſs they are to paſs through. I remember I have ſeen, not without ſome wonder, a ſort of Glaſs of ſo ſoft and reſoluble a Texture, that Veſſels of it of a competent thickneſs, would be manifeſtly prejudiced and wrought upon by Liquors, that were not conſiderably Sharp or Corroſive, if they were put in very hot. I have alſo heard of another ſort of Glaſſes, made in a certain Forreſt, complained of by a Deſtiller, as ſubject to be ſometimes injured by Corroſive Liquors. I once knew a Doctor of Phyſick, that by divers credulous Alchymiſts was ſuſpected to have, what they call the *Philoſophers Stone*, becauſe of a certain Book, Ingenious enough, that he was ſuppoſed to have written on that ſubject. But when after ſome acquaintance I happened to debate his Principles freely with him, he confeſſed to me, that he had been miſtaken, and to invite me to give him my thoughts upon ſuch like works, he frankly made me an ingenuous relation of his Proceedings, wherein the main thing that dazled him, and kept him from ſeeing his Error, was, that he had reduced the matter he wrought on, which was real Gold, to that degree of Fuſibleneſs and ſubtlety, that when he gave too ſtrong a Fire, as miſtake or curioſity made him ſeveral times do, the finer part of the Metal would ſweat through his Glaſſes, and ſtick ſometimes to the outſide of them, and ſometimes to the Neighbouring Bodies. And, when I objected, that he might be miſtaken in this, and that what he thought had come forth by tranſudation, rather iſſued out at ſome ſmall unheeded crack, he replyed that he had made the obſervation ſo often, and with ſuch care, that he was fully ſatisfied it was a real penetration of the Glaſs, by the attenuated Metal, which he was to have convinced me of by Tryal. But, before he could come to make it, by an Errour of his own he unhappily died.

But, whatever be judged of this penetrating Gold, I elſewhere relate, that I having upon a time deſtilled Spirit of Harts-horn with a very ſtrong Fire, into a Receiver that was large and thick enough, but of a courſe kind of Glaſs, it did appear, upon my beſt examination, that the Glaſs itſelf was penetrated by ſome vehemently agitated Fumes, or ſome ſubtile Liquor, that ſetled in ſtrongly ſcented drops on the outſide of the Receiver. But ſuch Inſtances being very rare, and happening but in ſome caſes or conjunctures of circumſtances, that are not like to be at all frequent, they cannot hinder the firſt part of our Propoſition to be true, in the ſenſe wherein 'tis laid down.

And, as to the ſecond part of the Propoſition, which *aſſerts Glaſs to be pervious to ſome Corporeal ſubſtances*, it may be proved *ad hominem* againſt any Epicurean that ſhould deny it, (and the Carteſians muſt not) by the free ingreſs and egreſs, which our ſeal'd Thermoſcopes ſhew, that the Atoms or Corpuſcles of Cold and Heat are allowed, through the Pores of the Glaſs, that contains the riſing or falling Tincture, or other Liquor. And without proceeding upon the peculiar Principles of the Epicureans, we may give more certain proofs of the Permeableneſs of Glaſs by certain Bodies. For I have elſewhere manifeſtly evinced that the *Effluvia* of a Loadſtone will attract and invigorate Steel, though incloſed in Hermetically ſeal'd Glaſſes; nay, I have alſo ſhewn by Experiment, that the *Effluvia* of ſo groſs and dull a Body as the Earth, are readily tranſmitted through Glaſs, and will operate on Iron, in Veſſels hermetically ſealed. If Light be, as probably 'tis, either a ſubtile and rapidly moving Body, or at leaſt require ſuch an one for its Vehicle, it muſt not be denied, that 'tis poſſible for a Body without difficulty to paſs through the Pores of Glaſs; ſince 'tis by its help that we can clearly ſee the Dimenſions, Shapes, and Colours of Bodies included in Glaſſes. To this I ſhall add, that far leſs ſubtile Bodies than thoſe that conſtitute or convey Light, may be made to permeate Glaſs, if their Figures being congruous enough to the Pores of it, their penetration be aſſiſted by an impetuous motion, or a brisk impulſe; as I have found by the increaſe of weight in ſome Metals, expoſed for divers hours in Hermetically ſeal'd Glaſſes, to the action of a Flame. On which occaſion I remember that having ſome years ago tryed the ſame Experiment with ſome Filings of Copper, they had indeed their colour much alter'd, being beautified with exceeding vivid Dyes, which they yet retain, but did not evidently appear to be increaſed in weight, as if, becauſe they but is produced by the cloſe adheſion of a deep Red, but thin and tranſparent, Pigment, to the ſurface of a Glaſſy Plate, through both which the Beams of Light paſſing to the Eye, receive in their Paſſage the colour of the Pigment.

But, as by ſome operations the Glaſs is rather Painted, or externally enamelled, than tinged, ſo in ſome others the Pigment or dying ſtuff appears to pierce a little beneath the very *ſuperficies* of the Glaſs, and the Yellow Colour will not only go further or deeper, but ſometimes ſeems (for I do not yet poſitively affirm it) to penetrate the whole Glaſs from ſide to ſide.

The Methods of Painting and ſtaining Glaſs, having been hitherto the Practices of a particular Trade that is gainful enough, and known but to few, the Artificers are wont to be ſhy of communicating their ſecrets, thô we know in general that Glaſs is ſtained, by having the Plates covered with Mineral Pigments, laid on Beds of beaten Lime, or ſome other convenient Powder, and kept for divers Hours in a ſtrong fire, but yet not ſtrong enough to make the Plates melt down, by which means the Pores of the Glaſs being much opened by the Heat, and the Pigments being likewiſe agitated, and ſome of them as it were vitrified with it, they are made either to pierce into the Plate, or at leaſt to ſtick very cloſely and firmly to it. But becauſe the Practices of Glaſs Painters require, beſides skill and experience, a particular Furnace, and divers Implements, I ſhall add, that to try, whether Glaſs may not, without ſo much ado, be ſo ſtained, as to ſhew it to be Porous, we took prepared Silver, (that Metal having, of all the Minerals I have tryed, the beſt Ingreſs into Glaſs) and having laid it upon a piece of Glaſs, not thick, nor yet ſo thin as to Melt very eaſily, we laid this Glaſs (with the Pigment uppermoſt) warily upon a few Quick-coals, and having ſuffered it to neal a while we gave it about ſuch a degree of heat, as might they were not of a Texture looſe enough to be melted, the Igneous particles could not pierce them enough to ſtick faſt in them, at leaſt in numbers great enough, to amount to a ſenſible weight.

But without the help of Fire, or any ſenſible Heat, I think it not impoſſible that Glaſs ſhould be freely penetrated by ſome kind of Corpuſcles, (though I do not yet know of what ſort they are) that ſometimes happen to roave about in the Air. This you will probably be ſurprized to read; but perhaps not more than I was at the *Phænomena* that induce me to write it. But becauſe theſe are very unuſual, and can ſcarce be diſcourſed of without ſome odd reflections hinted by them, I thought fit to ſet down a Circumſtantial account of them in another Paper, to which it more directly belongs than to this Eſſay; and therefore ſhall now only tell you, what may be ſufficient for my preſent purpoſe, namely, that having in two or three Vials cloſely ſtopt, kept a certain limpid and colourleſs

leſs Liquor, it would by fits acquire and loſe a high Colour, though I could not reaſonably impute the Changes to any manifeſt ones in the Air, nor to any other cauſe ſo probable, as the Ingreſs and Receſs of ſome very ſubtle and uncommon particles, which at that time happened to ſwim to and fro in the Air, and now and then to invade, and ſometimes to deſert, the Liquor.

There is another ſort of Experiments relating to the Poroſity of Glaſs, to ſhew that it may be pierced into by Bodies that are not corroſive in taſt, and are not Liquors, but only have a forced and temporary Fluidity, if they have ſo much as that.

Theſe Experiments may be drawn from *ſome of the ways* of colouring Panes of Glaſs, for the Windows of Churches and other buildings; I ſay, *ſome of the ways*, becauſe, to deal candidly with you, I think, and ſo I preſume will you ere long, that in divers of thoſe Glaſſes, the Colour doth not pierce at all deep into the Glaſs, but is produced by the cloſe adheſion of a deep Red, but thin and tranſparent, Pigment, to the ſurface of a Glaſſy Plate, through both which the Beams of Light paſſing to the Eye, receive in their Paſſage the colour of the Pigment.

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On this occaſion, 'tis likely 'twill be asked, whether there be any way of tinging Glaſſes quite through, with a true and beautiful red, and whether the Art of dying Plates of Glaſs, which the windows of many old Churches ſhew to have formerly been practiſed, be now (as 'tis commonly ſuppoſed) altogether loſt?

This Queſtion, conſiſting of 2 Parts, I ſhall quickly diſpatch; the former, by anſwering it without heſitancy in the affirmative. Yet adding withal, that the red tincture being communicated to Glaſs, not properly by mere penetration of the Pigment, but by the incorporation of it with Glaſs or its Materials, by the help of fuſion, I think the Experiment of no ſuch great uſe in our preſent Inquiry, as to hinder me from reſerving what I have obſerved about it to a more opportune place. And as to the ſecond Part of the inquiry, it being rather a Hiſtorical than a Philoſophical queſtion, I ſhall not here meddle with it; only I ſhall wiſh the queſtion may be cautiouſly ſtated. For, upon the burning the famous Cathedral of St. *Pauls* Church in *London*, many pieces of the red Glaſs that adorned the windows, were found broken and ſcattered about, ſome of which I procur'd from a Chymiſt, that had carefully preſerved them, deſigning to retrieve the loſt Invention of making the like. But when I came to examine them narrowly, I was confirmed in the ſuſpicion I had, that the redneſs did not penetrate the whole Glaſs, but proceeded from a diaphanous Pigment very artificially laid on, for though in other Poſtures no ſuch thing could be diſcerned, yet when I ſo held it, according to my Cuſtom in examining painted Glaſſes, that the ſurfaces of the Plate lay in the ſame level with my Eye, between it and the window, ſo that a broken edge was next my Eye, I could plainly ſee, and made the Chymiſt himſelf ſee, the lower part of the Plate to be of ordinary uncoloured Glaſs, upon which there lay a very thin Plate or Bed of a Diaphanous red Pigment, which, though it were not eaſily, was not impoſſible to be here and there ſcraped off.

But, to return to thoſe colorations that ſeem to pierce into the Pores of Glaſs, I remember that I had once occaſion to deſtil in a ſmall Retort ſome Gold amalgamed with ſuch a fine and ſubtile Mercury, that being (without the addition of any Salt) put to the Gold in the cold, they preſently grew hot together. And in the deſtillation of this uncommon mixture, I found the matter had, before it flew away, permanently died or ſtained, about an Inch in Diameter of the bottom of the

Glaſs, with a colour that, looked on from the Light, was like that of the better ſort of Turquoiſes; but beheld when 'twas interpoſed between the Window and the Eye, appeared of a ſomewhat Golden colour. And this Glaſs, with ſome others oddly colored, I have yet by me to ſatisfy the Curious, though I cannot but give Advertiſement, that the colorations of Glaſs may be much better performed with ſuch Plates, and in ſuch Furnaces, as the Glaſs-Painters uſe, than without them.

Since the Writing of the foregoing Paragraph, I was viſited by an induſtrious perſon, much addicted to ſome Chymical Operations, who had formerly adviſed with me about a Proceſs, of which I had had ſome Experience, that he conceived might be uſeful to him. I then acquainted him with ſome of my thoughts about it, and he having afterwards united Gold with Quick-Silver, (which by its Effects will be eaſily concluded not to have been common,) he kept them in Digeſtion for ſome Months, & afterwards coming to me with a Melancholy look, told me that the Fire having been once immoderately increaſed in his abſence, the ſealed-Glaſs burſt with an affrighting noiſe, and the included Amalgam was ſo ſtrangely diſſipated, that ſcarce the leſt fragment of it could be retrieved. But the Decoction having continued ſo long a time, it ſeems the matter was ſubtiliated enough to have a notable operation upon the Glaſs. For, though the upper part of the Bolt-glaſs were blown off, and ſhattered into many pieces, yet the lower part ſcaped well enough, and when he brought it me, to obſerve what change had been made in it, I took notice with much delight, that the Glaſs ſeemed to be tinged throughout, with ſo fine and glorious a Red colour, that I have ſeen ſeveral Rubies themſelves, in that point, inferiour to it.

FINIS.